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PACKING APPLES AND PEARS IN STANDARD CASES.

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Harvesting, packing, and storage are important links in the chain of operations in fruit-production, and very often the weakest. Common mistakes and some of the best methods in use at the present time are dealt with in the following pages.

HARVESTING THE APPLE CROP.

When to pick the Fruit.—Apples usually are best picked as soon as they reach maturity. This may be indicated by the colour of the skin or seeds, also the flavour and the readiness with which the fruit parts from the tree. It is not always so much the red colour of the skin as the shade of ground-colour; this perceptibly lightens as the fruit approaches maturity. Wide experience and careful examination are necessary to decide this important point, the neglect of which is a common and serious mistake. If left on the trees too long the skin of the fruit is liable to be disfigured by spotting, the texture of the flesh deteriorates, and juice and keeping-qualities may be lost. The harvesting of apples commences early in January, and recognized commercial varieties are ready for picking according to the purpose for which they are required in approximately the following order: Gravenstein, Scarlet Pearmain, Worcester Pearmain, Golden Pippin, Willie Sharp, Ribston Pippin, Alfriston, Cox's Orange Pippin, King David, Dunn's, Jonathan, Delicious, Lord Wolseley, Cleopatra, London Pippin, Ballarat, Rome Beauty, Grannie Smith, Statesman, Sturmer, and Dougherty, the latter reaching maturity about the end of the month of April.

Picking-equipment.—The fruit is best picked and placed in a substantial bag or bucket suspended from the shoulders in a way that it will not swing unduly, hinder the picker, or bruise the fruit. Strong orchard-boxes are required, and into these the fruit is emptied from the picking-bag. Handy tressels and ladders, no higher than necessary and as light as possible, are most suitable for picking the upper branches. The three-legged ladder commonly used is very suitable. To collect the orchard-boxes when filled, a low-wagon without sides is used to cart the fruit to the packing-shed, or on rough ground a large sledge may sometimes be used.

FIG. 1. HARVESTING THE APPLE CROP.

Note the tripod ladder and picking-buckets. Cases should be filled only within an inch of the top to avoid bruising when stacking.

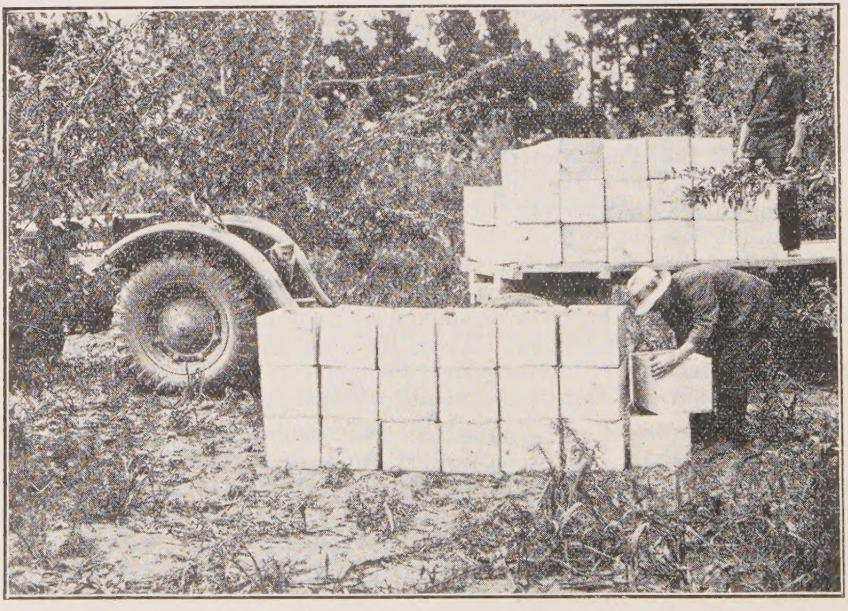

FIG. 2. A LOW-SET, WELL-SPRUNG WAGON IS MOST SUITABLE FOR CARTING APPLES FROM THE ORCHARD.

How to pick.—Inexperienced pickers should be carefully supervised until they become accustomed to the work. Apples on a tree do not all mature at the same time, and serious loss has been incurred by immature fruit being picked. The apples at the top and on the sunny side of the tree mature first; the remainder as the colour and size develops are picked. For some varieties several pickings are necessary.

The fruit should be picked with an upward movement, when, if mature, it parts readily without injury to the spur, without loss of the stem or rupture of the base of the stem, which is the cause of so much stem-rot in storage. At a picking all mature fruit should be gathered. If any is overlooked or immature fruit picked, there is a loss. Pickers should trim their finger-nails close, and handle the fruit with the greatest care to prevent injury or bruising. Orchard boxes are filled so that they may be stacked without bruising the fruit, and stood on the shady side of the tree in readiness for carting. Unsound fruit should not be placed in the boxes. There is usually very little, and it is generally best placed at the foot of the tree, where it may be collected later.

Packing Apples in the Standard Case.

The Packing-shed.—As a considerable quantity of fruit will be in this building during the summer and autumn, also possibly during the winter awaiting a market, it should be placed in a cool as well as convenient position.

A concrete floor is very suitable, as it is easily kept clean, and wooden floors often give trouble when carrying heavy loads. A good light is required on the packing and grading tables, and ample ventilation in the gables or along the ridge of the roof, in addition to wide doors for the traffic of goods. The house should be built so that as little dust as possible can lie about, as cleanliness in the packing-shed enhances the keeping-qualities of fruit. The shed should be of sufficient size to accommodate an ample supply of fruit in orchard-boxes, packing-equipment, and stacks of packed fruit. The timber and box-making department is generally in an annex, or in a loft above the ground floor.

Packing-equipment.—Equipment for the packing-shed consists of a boxmaking bench, fruit-grader, nailing-press, and wiring-machine; also supplies of timber, nails, wrapping-paper, liners, pads, labels, rubber-stamps, paste, brushes, and wire. In a large establishment a section of the shed is partitioned off for an office and store-room for supplies. The arrangement of the equipment is carefully studied so as to secure the greatest economy of labour. Roller conveyers carry the packed fruit to the nailing-down press. In such an establishment a mechanical grader is used to size the fruit and convey it to bins, in each of which fruit of one size is piled ready for the packer. Mechanical graders of different styles and capacity may be obtained for this purpose. For driving the mechanical grader an electric motor is preferred. An oil-driven motor is a good substitute, but it should be placed outside the packing-shed under cover. Artificial lighting is a great convenience, as it enables packing to be done at night during rush periods. The grading-table, packing-bins, and nailing-press should receive special attention in this respect.

In many small establishments the fruit is graded and sized by hand, either direct from the orchard-boxes or from a hessian-covered table on which the fruit has been tipped. A row of bins for fruit of different sizes will then be required. Useful equipment of this kind can very well be made by the orchardist.

The standard apple-box, having an inside measurement of 10½ in. by 11½ in. by 18 in., is made up from cut timber supplied in bundle form with definite counts of end, side, top, and bottom pieces, and cleats, the dimensions of which are as follows:—

Ends: Two pieces, each planed on one side, ¾ in. by 11½ in. by 10½ in.
Sides: Two pieces, 5/16 in. by 19½ in. by 10½ in.
Tops and bottoms: Four pieces, 3/16 in. by 19½ in. by 5½ in.
Cleats: Four pieces, 5/16 in. by 11½ in. by ¾ in.

Cases made of two-piece sides and two-piece ends are sometimes used, provided the side boards are of equal width and are cut or planed to an equal thickness. The grain of the end boards is parallel with its greatest measurement and the two pieces are securely joined by means of corrugated fasteners, one close to each edge on the one side and one midway between on the reverse side.

The local timber recommended for the construction of export cases is white-pine of good quality, but *Pinus insignis*, rimu, or beech timber is acceptable if properly cut and used with flexible tops and bottoms not exceeding 3/16 in. in thickness.

The nails used are at least 1½ in. long, 14 gauge.

All fruit exported, and much of that which is placed on the local market, is wrapped individually in paper glazed on one side.

The following sizes are most suitable:—

For apples 96 and larger to case use 11 in. by 11 in. paper or double wrap with 10 in. by 10 in.
For apples 100–138 to case use 10 in. by 10 in.
For apples 150–180 to case use 10 in. by 10 in. or 9 in. by 9 in.
For apples 198–234 to case use 9 in. by 9 in.
For apples 252–270 to case use 8 in. by 8 in.

Organization of the Staff.—A large packing-shed during the harvest is a very busy place, and good administration is necessary to get the work done quickly and well. If the planting has been done wisely, the harvest will be conveniently spread to enable large quantities of fruit to be handled with a moderate sized staff.

It is important to see that pickers, graders, packers, boxmakers, and the man nailing down thoroughly understand their duties as they are very exacting. The supply of fruit from the orchard and casemaking should be regulated to the requirement of graders and packers, to avoid congestion and double handling or loss of time. Help will also be required to supply fruit to the graders, empty boxes to packers, and remove low-grade fruit. Good management will secure a happy, capable crew that will do good work without waste. The man nailing down and wiring cases should be very capable and familiar with all regulation requirements. He should return all packed boxes not up to standard, as he is the last man to see the pack he should be finally responsible.

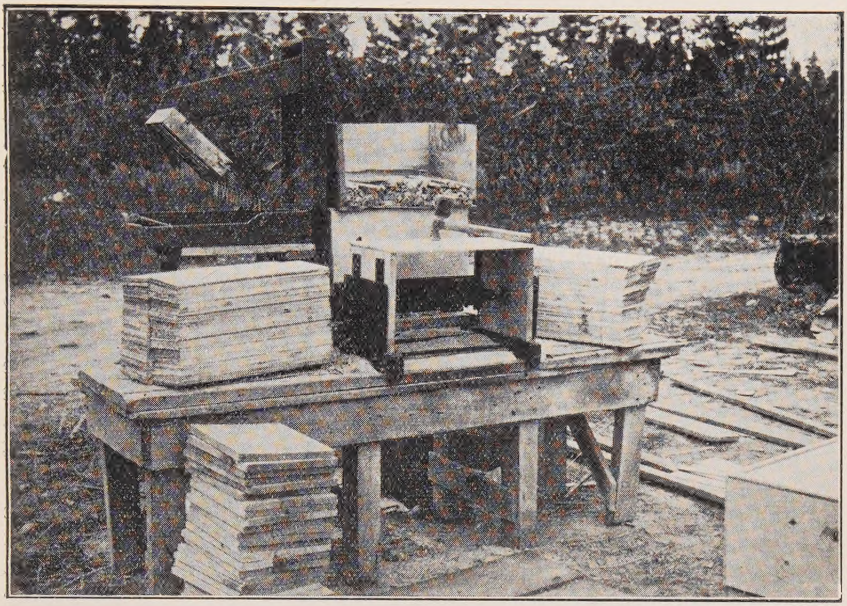

FIG. 3. TO MAKE GOOD BOXES QUICKLY A SUBSTANTIAL BENCH, PROPERLY EQUIPPED, IS REQUIRED.

FIG. 4. LABELS MUST BE CLEAN AND LIGHT. LINE UP THE BOXES, APPLY A GOOD PASTE, THEN THE LABELS, AND FINISH WITH A CLEAN BRUSH.

Making and labelling Boxes.—To give a box good appearance and sufficient strength, boxmaking and labelling are carefully specified, and this should be carried out with equal care. The end pieces of a box are placed in a steel or wooden frame on the bench, planed side outermost, one side is nailed on; it is then turned and the other side board is fastened in position, after which the bottom pieces and cleats are laid in position and securely nailed. The corners should be square and flush, and the nails, spaced not more than 3 in. apart, should be driven flush and not sunk; the outer nails being not more than 1 in. from the edge of the board. Nails with point projecting when driven must be withdrawn. All cases should be clean, dry, and sound, and well up to measurement.

As the contents and consignment-marks are usually placed on the label, the necessity of good labelling is obvious, for when they become torn or lost altogether, as sometimes happens, serious difficulties arise. There are many right ways and wrong ways of labelling; one of the former is as follows:—

Place the box-ends planed side uppermost before making up in a row on a bench, or slide long enough to hold twenty-five or fifty of them. Apply the paste to the boards with a wide brush, and then take the labels and place them carefully in position. With a clean brush each label is then pressed firmly to the wood with a motion from the centre outwards to avoid air bubbles, and the labelled ends are stacked to dry before making them up. Any convenient method is satisfactory so long as a clean, fresh, reliable paste is used and the label is properly placed and firmly affixed over the whole of its area. Labels should as far as possible be overprinted with essential particulars, leaving only the count—that is, the number of apples per case—to be applied with a rubber stamp.

For the export trade a label of approved design is placed on each end of every case, words and figures indicating the following only are permissible on the label: (1) "New Zealand Apples"—"New Zealand" to be composed of $1\frac{1}{4}$ in. letters and the word "Apples" $\frac{3}{4}$ in. in height; (2) grower's registered number to be of $1\frac{1}{4}$ in. type; (3) consignee's registered number or shipping-mark to be of figures not less than $2\frac{1}{2}$ in. and not more than 3 in. in height; (4) name of variety of apple, grade, and number of apples in the case—all of which must be of $\frac{1}{2}$ in. type. The grade is printed on each label. The name of the variety must be placed immediately above, and the number—indicating the apples in the case—on the right of, and in line with, the grade name. These particulars are usually overprinted on the label, with the exception of the count, which is applied with rubber stamps at the nailing-press.

Grading and Sizing the Fruit.—The fruit in orchard boxes are received at the packing-shed and stacked to a convenient height from five to six cases high, according to the space available adjacent to the grading-table. Fruit may be stacked on both sides of the grader if space will permit, as this enables the person in charge of the grading to deal with the fruit according to the length of time

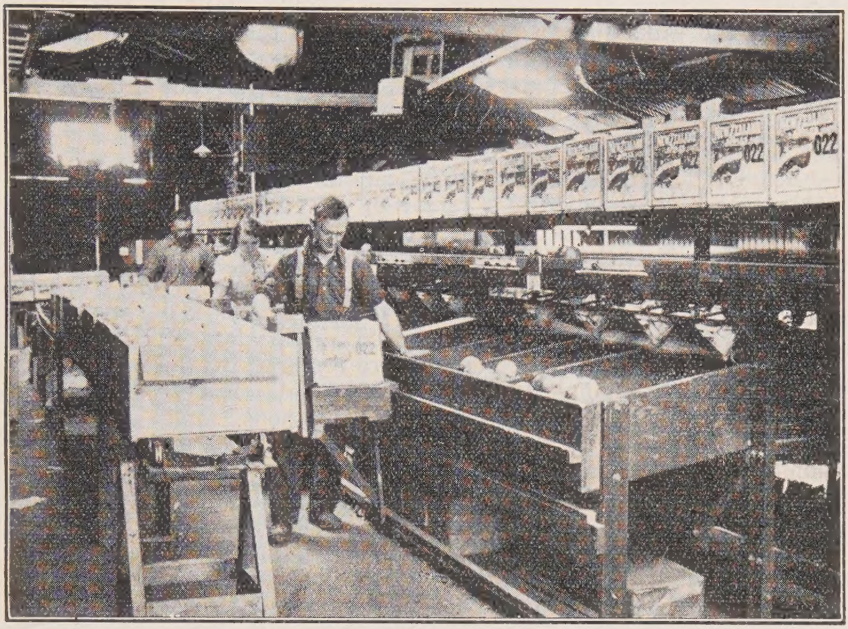

FIG. 5. INTERIOR OF PACKING-SHED DURING THE HARVEST.

Over the grading-machine are the empty boxes. As they are packed the packers' tally-card is inserted and the box is placed on the conveyer and passed to the lidding-press.

FIG. 6. EQUIPMENT SUITED TO ANY REQUIREMENT IS NOW AVAILABLE.

it has been picked. To prevent heating and to allow the air to circulate through the stack, the cases should stand a few inches clear of the walls and an inch or so between the perpendicular tiers. It should remain there at least twenty-four hours to permit a certain amount of evaporation, which will minimize wet brushes and blemish marks in packing and handling. This is specially important if recent rains have been experienced.

The fruit is graded and sized by carefully tipping it on a grading-table, where defective fruit is removed, placed in boxes, and stacked by itself. The remainder is passed over a sizing-machine and comes to rest in bins, in each of which the fruit is all of one size and grade ready for the packer. Most machines of this kind of any capacity do good work, but it is essential that they be kept thoroughly clean and adjustments carefully watched. Apart from this mechanical supervision, less skill and experience are required by the operators as compared with grading and sizing by hand. The latter method, however, is suitable for small packing-sheds, and experienced operators will instantly decide the grade and size of fruit when they handle it. Such graders sort into a row of bins from one side, while the packers pack out of the bins on the other side. The bins have padded bottoms, which are slightly inclined towards the packers, and have an opening, an inch or so wide, between the lower edge and side of the bin to allow dust and litter of any kind to be readily removed by brushing. The graders may work from orchard-boxes or from a narrow table about 2 ft. wide covered with hessian on which the fruit is tipped.

A common fault which tends to injure fruit while grading is the overloading of the grading-table, conveyer-rollers, and belts, resulting in crowding apples in restricted spaces, causing stem punctures, scratches, and abrasions. Sufficient fruit only to keep the packers employed should be allowed in the bins. Overloading the packing-bins is a common source of injury to fruit.

Standard grades for apples and sizes packed are subject to slight alteration each season—those set for the 1937 export season are as follows :—

"Extra Fancy," "Fancy," and "Good" Grades.—Apples of these grades shall be mature, sound, smooth, clean, well formed, carefully hand-picked from the tree, properly wrapped, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer. Individual apples of either grade shall carry not less than the percentage of colour, and not more than the percentage of blemish and unnatural russet indicated in the appended general list with respect to each variety in the respective grades.

Insignificant, healed-over insect stings or bites in export fruit shall be limited as follows: "Extra Fancy," not exceeding 5 per cent., with no more than one sting or bite on individual fruits; "Fancy" and "Good" grade, not exceeding 10 per cent., with no more than two stings or bites on individual fruits.

XF = Extra Fancy; F = Fancy; G = Good; HCC = High characteristic colour; GCC = Good characteristic colour.

Varieties.	Sizes. United Kingdom. Max.	Sizes. United Kingdom. Min.	Sizes. Continent of Europe. Max.	Sizes. Continent of Europe. Min.	Sizes. Other Markets. Max.	Sizes. Other Markets. Min.	Colour. XF, %	Colour. F, %	Colour. G, %	Blemish. XF, %	Blemish. F, %	Blemish. G, %	Russet. XF, %	Russet. F, %	Russet. G, %
Solid Red.															
1. Rokewood ..	125	252	125	198	125	252	60	25	10	3	3	5	5	10	20
2. Tasma	125	216	125	198	125	216	70	30	10	3	3	5	5	10	20
Partial Red.															
3. Brighton	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
4. Delicious	125	216	125	198	125	216	45	15	5	3	3	5	5	15	30
5. Dougherty ..	125	252	125	198	125	252	45	15	5	3	3	5	5	10	20
6. Frimley Beauty ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
7. Glengyle Red ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
8. Jonathan ..	125	234	125	198	125	234	45	15	5	3	3	5	5	15	25
9. Scarlet Nonpareil ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
10. Stark	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
11. Worcester Pearmain	138	234	..	..	138	234	45	15	5	3	3	5	5	10	20
12. Yates	138	252	138	198	138	252	45	15	5	3	3	5	5	10	20
Striped.															
13. Cox's Orange Pippin	150	270	..	..	150	270	20	5	*	3	3	5	5	30	50
14. Gravenstein ..	138	234	..	..	138	234	†	†	†	3	3	†	5	10	†
15. Kidd's Orange Red	138	234	138	198	138	234	25	10	*	3	3	5	5	10	20
16. Rome Beauty ..	125	234	125	198	125	234	25	10	*	3	3	5	5	10	20
17. Statesman ..	125	234	125	198	125	234	20	5	*	3	3	5	5	10	20
Yellow or Green.															
18. Alfriston	88	198	88	198	88	198	HCC	GCC	..	3	3	..	2	12½	No good grade allowed
19. Ballarat	88	198	88	198	88	198	HCC	GCC	..	3	3	..	2	12½	
20. Cleopatra ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	2	12½	
21. Dunn's	96	216	96	198	96	216	HCC	GCC	..	3	3	..	2	12½	
22. Golden Delicious ..	125	216	125	198	125	216	HCC	GCC	..	3	3	..	2	12½	
23. Grannie Smith ..	113	234	113	198	113	234	HCC	GCC	..	3	3	..	2	12½	
24. London Pippin ..	125	216	125	198	125	216	HCC	GCC	..	3	3	..	2	12½	
25. Lord Wolseley ..	113	216	113	198	113	216	HCC	GCC	..	3	3	..	2	12½	
26. Newtown Pippin ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	2	12½	
27. Parlin's Beauty ..	96	216	96	198	96	216	HCC	GCC	..	3	3	..	2	12½	
28. Pioneer	138	234	138	198	138	234	HCC	GCC	..	3	3	..	2	12½	
29. Sturmer Pippin ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	15	75	
30. Willie Sharp ..	125	234	..	..	125	234	HCC	GCC	..	3	3	..	2	12½	

* Colour showing. † Colour requirements of Gravenstein: Extra fancy—pronounced stripe; Fancy—clean bright fruit. Good grade of this variety will not be accepted for export.

(To be continued.)

On a light-land farm in Canterbury two adjacent paddocks, which had originally been sown down with the same mixture, provide a striking example of what subterranean clover can do for a pasture. One of these paddocks was surface-sown with subterranean clover two years ago and now carries a good cover of rye-grass, while the pasture in the other paddock has entirely run out, being practically all hair-grass.

LIVER-FLUKE IN NEW ZEALAND SHEEP.

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SPORADIC outbreaks of black disease in sheep have occurred since the first investigation of the trouble in the years 1924 to 1928 in spite of the efforts that have been made to control the factors causing mortality. It was shown at that time that the larval liver-fluke (*Fasciola hepatica*) entered the liver and burrowed through the tissues to stimulate the growth of the bacillus *Clostridium oedematiens*. The toxin derived from the bacillus caused the death of the infected animal. During the first half of 1937 the death of at least five hundred sheep, chiefly breeding-ewes, from black disease has come to the notice of the Department in Hawke's Bay. In addition to this loss there is still a large number of rejections of livers at the meat-works because of the presence of fluke, and the liver-fluke is, after hydatids, the most serious cause of condemnation of livers at the works in the fluke area. Direct loss of sheep, however, or wasting of their condition from the presence of large numbers of adult fluke in the bile-ducts is now negligible as a result of the regular drenching with carbon tetrachloride which has been undertaken in Hawke's Bay.

The mammalian hosts of the liver-fluke are sheep, cattle, goats, rabbits, and, occasionally, man. It was formerly considered that the intermediate host of the parasite was the small black mollusc *Potamopyrgus*. Large populations of *Potamopyrgus* spp. are common in streams and lakes throughout the country. This genus is sharp-spired, there are six tight whorls to the shell, and the opening of the shell is able to be closed by an operculum (Fig. 1 (v)). This is not the host of the liver-fluke, however, though it harbours the immature forms of at least fourteen other flukes whose adults live in fish, birds, or mammals. An examination of 5,200 specimens of this genus did not reveal one infection with fluke; and that observation was supported by the fact that the miracidium hatched from fluke eggs would not penetrate the tissues of *Potamopyrgus antipodum* or *P. corolla*.

In Hawke's Bay and Poverty Bay the only intermediate host of the fluke that was discovered in the recent reinvestigation was *Myxas ampulla* (Fig. 1 (iii), (iv)). This snail grows to the length of one centimeter. It is a broad-shelled animal of a grey or green-brown colour. There are four whorls to the shell; the first three apical whorls are small and the fourth is large and ovoid to shelter the greater part of the animal. The fleshy foot protudes slightly from the opening of the large whorl, and there is no operculum to the shell. Examination was made of 2,300 specimens of this snail, and fluke infection was found to vary in different localities from complete absence to 43 per cent. In a normal fluke-infested pasture there are usually about 5 per cent. of the *Myxas* carrying parasites. The identity of the parasite was established by feeding the cysts to laboratory-bred rabbits, from which mature fluke were recovered after fifty days.

Occasionally species of *Isidora* (Fig. 1 (i), (ii)) may be found in lagoons, but they may be readily distinguished from the fluke snail by the fact that the whorls twist to the left. In *Myxas* the whorls twist to the right.

Habitats of Myxas ampulla.

The habitats of *Myxas* are well defined and limited. The snail is an air-breathing animal adapted for life on muddy areas. Accordingly it is not found in deep or fast-running waters with clearly cut banks. The characteristic locality in which *Myxas* lives is a seepage from the hillside where the flow of water is imperceptibly slow but is constant throughout the year. Stagnant water is quite unsuitable: it is well-aerated water that is required. A short green

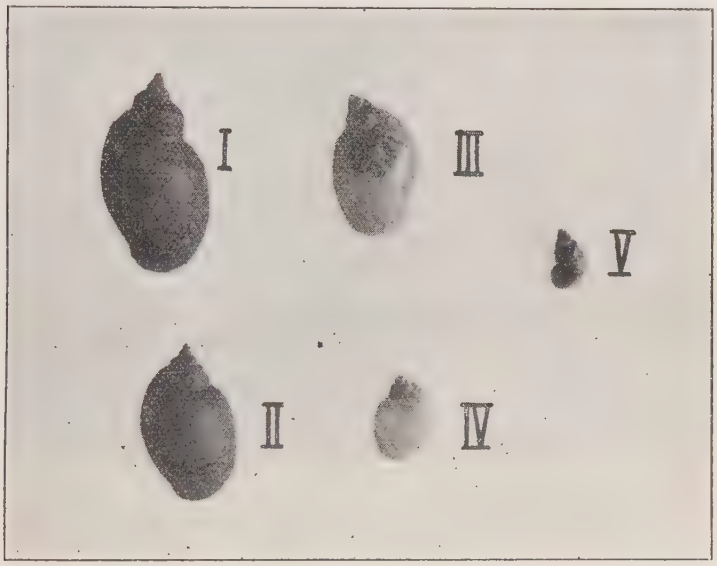

FIG. 1.

I and II: *Isidora* spp. These molluscs are rare, and are not infected with fluke. III: Full-grown *Myxas ampulla*, 1 cm. long. This snail is the only known host of liver-fluke in New Zealand. IV: Half-grown *Myxas ampulla*. V: *Potamopyrgus antipodum*. The common and widespread stream snail that has been shown *not* to be on intermediate host of the fluke.

rush (*Juncus lampocarpus* (Fig. 2)) grows in such seepages, and when it is growing sparsely with extensive patches of bare mud in the association it provides the best habitat (Fig. 3). Only fine silty loams form a suitable substratum for *Myxas*, which may be found either moving over the soft mud or mating in the water-filled hoof-marks of the swamp.

Where the *J. lampocarpus* grows very densely or where large growths of moss and algæ have taken place, *Myxas* will seldom be found.

Besides on the swamp ground formed from springs, fluke-snail habitats develop on flats in the course of streams where depositions of silt have been overgrown by short green rushes. Some good cultures of *Myxas* are also found on open stretches of soft mud where *J. lampocarpus* does not grow. An example of this occurs on the bed of the former Inner Harbour at Napier.

FIG. 2.

FIG. 3.

Fig. 2.—A single plant of *Juncus lampocarpus*, the short rush that grows on the fine mud of the swamps inhabited by *Myxas*.

Fig. 3.—A typical fluke-infested area formed from a hillside seepage. Water is seen lying in depressions trampled by stock with a growth of *Juncus* around each depression. The silt of this swamp is formed from sandstone, limestone, and Taupo pumice, and is grey-brown in colour.

Patches of watercress, drains in which the water flows fairly rapidly, and stagnant brown waters are unimportant in the spreading of the fluke. Sluggish drains that have become overgrown with cress or rushes accommodate small numbers of *Myxas*.

Stock are infected, therefore, by eating the rushes or drinking from depressions in the swamp where fluke cercariæ are encysted.

Distribution.

The liver-fluke has been reported from areas near Nelson, Opotiki, and Ngaruawahia, and its incidence has been studied in Hawke's Bay and Poverty Bay. Fluke swamps are formed on grey, brown, and dull-yellow

soils. The derivation of these soils is limestone (grey), limestone, sandstone, and pumice (grey-brown), sandstone (dull yellow), and mudstone (grey). On the east coast of the North Island limestone and sandstone fluke habitats are found from Dannevirke to Tutira. From Tutira northwards the coastal soils are basically either sandstone or mudstone, with a short outcrop of limestone from Nuhaka to Tiniroto.

Very few snails and no fluke have been found on the red soils formed from the volcanic ash showers (from Tongariro) which do not extend farther east than Kereru, Puketitiri, and Te Pohue. The Taupo rhyolitic pumice does not disturb the incidence of *Myxas*. Peat and peaty loam is inimical to *Myxas*. South of Dannevirke, and in the greywacke foothills of the ranges (Ruahines, Raukumaras, Kawekas), the snail has not been seen. In those areas the soils are either derived from greywacke or are dun-coloured bush soils, neither of which provides a favourable substratum, though *Juncus* swamps are common.

Thus fluke is present on limestone and sandstone, but it is absent from peat, andesitic volcanic ash, and bush soils.

Biology of Myxas and the Fluke.

Pastures are infected with fluke-eggs continuously throughout the year. It has been shown that an individual fluke may survive in the liver for three years, though one year is a more usual length of life. During adult life the fluke does not cease to produce eggs. In Hawke's Bay during the summer and autumn the eggs hatch in two or three weeks according to temperature. In April, however, the time of hatching lengthens, till in May there is practically no development of the embryo. A mean monthly temperature of 50° F. is necessary for appreciable hatching, and the rate of development is directly determined by the mean temperature. Hatching is negligible from May to October in Hawke's Bay.

During the winter *Myxas ampulla* breeds slowly and a considerable mortality of the larger snails takes place. By October the first spring generation of snails is ready for infection with the newly hatched fluke-larvæ. The immature fluke develop during seven weeks in the snail and digest their way out at the end of that period to encyst on the mud or on the stems of *Juncus lampocarpus*.

It would appear that the most suitable time to kill the host snail is before the liberation of young fluke from November onward and after the winter flood waters have receded. It is not advisable to poison the snails when the swamps are at their maximum size since bluestone would be wasted on areas that would not support snails during a dryer period. Any dry spell during August, September, or October would therefore be a suitable time for bluestoning, and similarly in April the swamps are usually well defined and the killing of the intermediate host may be more easily carried out. The use of copper sulphate, however, appears not to be so valuable as it was formerly considered to be. This is due to the facts that the snail requires a considerable concentration to kill it, that much of the copper in limestone country is

precipitated as an insoluble carbonate, and that the eggs and many of the snails living amongst the vegetation never come into contact with the poison. Swamps that have been bluestoned heavily during several years have been found still to carry an infection of *Myxas*. Bluestone is of value in controlling *Myxas* living in choked drains, but it is in no way to be considered as a substitute for draining.

The eggs of the fluke and of the snail are almost unharmed by copper sulphate, so that the effectiveness of the poison is restricted to newly hatched and adult snails. Bluestone is most satisfactorily used by scattering the powder at the rate of 20 lb. to 40 lb. per acre over mud and water-filled hoof-marks in the *Myxas* habitats. There is considerable wastage and small effect from placing bluestone in bags in the course of streams, since, even if there is a swampy area at the side of or in the course of a stream, it is often not directly in the flow of stream water. The bluestone must go on the mud. Copper sulphate has, of course, no ill effects on stock in the concentrations available.

Myxas is killed by complete drying for one day, but is able to survive on or in damp mud for several weeks. Its eggs, too, persist on damp mud. In view of the relative inefficiency of copper sulphate in controlling the snail population, draining of swampy areas seems by far the best method of eradicating the liver-fluke. If a drain is dug 2 ft. deep and 2 ft. wide at the top it reduces the amount of water on the mud where *Myxas* lives and within a year has made the locality unsuitable to the snail. Complete drying out is not necessary, and as soon as prolific growth of moss, or an invasion of white clover takes place the drains' function is practically fulfilled. They must, however, be kept as clean as possible with a fast flow of water for at least three years.

The major liberation of flukes from the host snail takes place in late spring and summer. Lambs are found to be infested with mature fluke by the end of January, so that the encysted cercariæ are available on the pasture in numbers by the beginning of December. In suitably moist and cool conditions the cysts are known to survive from one season until the next, but the number of these survivors will be small compared with the number of newly-formed cysts. The survival of infective flukes accounts for cases of black disease outside the usual February to June season. When the fluke cyst has been taken in by the sheep the young fluke burrows through the wall of the intestine and in from five to fourteen days penetrates the liver. As the fluke digests its way through the tissues of the liver a condition is set up in which the spores of the black disease bacillus germinate and commence vegetative growth. The bacterial toxin produced kills the sheep. There is no cure, but prevention of the growth of the bacillus by vaccination before February is possible. In addition, the burning of carcasses and eradication of *Myxas* should be undertaken to prevent a recurrence of the disease.

Within fifty days of the time cysts are ingested the bile-ducts of the liver may contain egg-laying fluke. Thus the young parasite spends at least six weeks in the liver-tissues before migrating to

the bile-ducts. In the mature stage (only) fluke may be removed from sheep by drenching with 1 c.c. of carbon tetrachloride. Any time of the year is suitable for drenching, but it must be remembered that one dose will remove only the adults. So the bile-ducts will receive parasites constantly from the liver-tissues for two months after the first dose even if there is no further infection. This makes further drenchings necessary.

The most useful time, however, at which to administer carbon tetrachloride is late autumn. Drenching in April and June will remove the major infection acquired in summer and autumn. This procedure will prevent the fluke from infesting the pasture with its eggs throughout the winter and relieve the sheep of the parasite burden which might be dangerous during a bad season. Spring and summer drenching should not be neglected in the more seriously infected areas.

Winter.	Spring.	Summer.	Autumn.
Few *Myxas*. Few *Myxas eggs*. No fluke-eggs hatch.	Fluke-eggs hatch. Infection of snails with fluke. *Myxas* breeding.	Liberation of fluke from snails. Larval fluke in livers of stock.	Cysts available on pastures. Adult fluke in liver.
Drenching. Draining.	Bluestoning of swamps.	Vaccination of ewes against black disease. Drenching.	Bluestoning. Drenching.

The above scheme illustrates the periodicity of the fluke and its host and relates that periodicity to the measures necessary for the eradication of the parasite.

To Dr. C. S. M. Hopkirk, who instigated this work, I am grateful for assistance in experimental infections and for many facilities. Regional officers of the Department of Agriculture lent valuable assistance, and the hospitality of station-owners on the east coast was both useful and greatly appreciated.

DAMAGE BY SLUGS.

J. MUGGERIDGE, Government Entomologist.

IN connection with the garden slug *Agriolimax agrestis*, the following information culled from the literature should be of assistance:—

The slugs belong to the same division of the animal kingdom as snails, clams, and oysters. They are typically nocturnal in habit, and by far the greater portion of the damage caused by them is carried on at night, in dark, moist, cloudy weather; however, they remain active throughout the day.

The food habits of the above species are surprisingly variable; it is almost an omnivorous feeder with a preference for a vegetable diet. Feeding takes place below, at the surface, or above the surface of the soil. Among vegetables Cruciferae seem the favourite host, lettuce, cabbage, and cauliflower particularly, and radishes and turnips to nearly the same extent. Peas, beans, tomatoes, potatoes, and beets are seriously attacked. Among field crops probably peas and beans are more generally injured, though rape, clover, wheat, oats, and many other crops suffer.

Data concerning life-history studies is meagre. The eggs occur at all seasons of the year, but are more common in the spring and early summer. They are placed under stones, boards, and rubbish, under accumulations of grass and weeds, about fence rows and in other moist, shady places. Where natural protection is not available the slugs burrow out a small shallow pit in the surface of the soil with smooth rounded sides and a surface opening. The eggs are laid in clusters of from two or three to fifty or sixty and more. The period from egg to maturity will vary with the season and abundance of food, but is probably from ninety days to nearly a whole year. No data is available concerning average longevity of the slug, though one writer states that the average span is probably from eighteen months to two years.

Control for Slugs.

(*a*) *Climatic.*

Adverse climatic conditions, such as dry, hot weather, drives the slugs into seclusion and tends to minimize injury. Under conditions where plant foliage is luxuriant, however, slugs may find conditions suitable for their depredations—for example, during summer months it is common to find slugs in leafy cabbages or cauliflowers, &c. Excessive rain drives slugs from their seclusion, and frequently they will drown in small pools of water. During cold weather they are likely to remain dormant, but probably cold does not kill them.

(*b*) *Natural Enemies.*

Poultry, particularly ducks and geese, seem especially fond of slugs. Several birds, such as the thrush and blackbird, occasionally feed on them. They are attacked by some species of insects, but comparatively little has been done on this aspect of the problem.

(*c*) *Clean Surroundings.*

Owing to the habits of the slug in seeking shelter among debris, in long grass, under boards, &c., it will be clear that, following a thorough cleaning-up of all such places, a considerable reduction of the slug population should result. Remove and burn all trash and rubbish when possible. Autumn ploughing should be adopted where practicable and the ground kept clean from weeds.

(*d*) *Applied Control.*

The use of quicklime is, of course, an old remedy and quite effective under some conditions. A more recent remedy which has been recommended by some writer consists of dehydrated copper sulphate (bluestone) plus hydrated lime in the proportions of one part of the former to ten parts of the latter. This mixture must be kept in closed cans to avoid dampness. No experimental work has been conducted in New Zealand to determine the relative value of this compound as compared with other "slugicides," but the writer has found it useful in checking an outbreak of slugs found to be infesting field cabbages. The mixture should be applied with a dusting-machine at the rate of 30 lb. to 50 lb. per acre. The best time to apply it is on a warm evening after a drizzling rain or, perhaps better still, in the early morning following moist conditions and at a time approximately when the day is breaking. The effect of the dust on the slugs is to cause profuse salivation and death within a few minutes

THE AGRICULTURAL YEAR.

ITEMS FROM THE DEPARTMENT'S ANNUAL REPORT.

THE annual report of the Department of Agriculture was presented to both Houses of the General Assembly recently. It provides a summary of the principal farming activities of the year, and outlines the comprehensive and numerous activities of the Department in its work of maintaining and fostering the growth of the rural industries. The following items of an instructional and informative nature to farmers have been culled from the reports of the Directors of the various Divisions of the Department :—

JOHNE'S DISEASE.

The evidence accumulated throughout the year shows that this chronic disease of cattle is being reported on several fresh farms from time to time. In the Waikato the disease was confirmed on seven fresh farms during the year, and in Taranaki the disease was shown to exist on ten further farms. Although on many of these farms the actual number of cattle affected with the disease is small, the increase in the number of farms affected, together with the difficulty of knowing the exact extent of the disease in any one district, makes the problem of control of the disease a serious matter. The chronic nature of the disease, with the long period of incubation before clinical symptoms are shown, is a feature of the disease which handicaps the most enthusiastic worker in any survey as to the exact incidence in any district.

In the control of the disease the Johnin test is being availed of by veterinarians in the Taranaki and Waikato districts. In the Waikato district this work is being carried out by Mr. Marshall, assisted by Mr. McDonald. In the Taranaki district Mr. Stephens, Stratford, carried out the intradermal Johnin-testing. The South Taranaki district work in connection with Johnin-testing is now being carried out by Mr. Alexander, Hawera. The slow and exacting nature of this work being carried out and recorded reflects credit on the officers concerned.

A semi-annual Johnin test is being applied to a number of herds, and reactors are being slaughtered. It is hoped in this way to eventually eradicate the disease from such herds. The draining or fencing of swampy areas and subsequent heavy dressing with lime are measures adopted with a view to eradication of the infection from contaminated farms. A series of semi-annual tests must be applied, and some time must elapse before any definite statement can be made.

In order to prevent the spread of the disease it is now necessary to have all dairy cattle intended for shipment to the South Island tested by the double intradermal Johnin test prior to shipment. Although a limited amount of testing in this connection has been done, it is gratifying to know that so far no reactors have been found. This is evidence that the disease is confined to definite areas.

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MAMMITIS.

The position in regard to mammitis during the year would appear to be less satisfactory. The larger number of cases in many districts

can be attributed to the very variable season with the higher rainfall in the spring and throughout the summer. Under such seasonal conditions the sanitation measures necessary in and about many milking-sheds cannot be maintained, and an increasing number of cows show mammitis as a consequence. In wet seasons there is an increase in the number of cows affected with pox on the udder and general abrasion of the teats, resulting in more cases of mammitis. A high standard of hygiene in the shed is difficult to attain in such a season.

The facilities provided by the Wallaceville and Hamilton laboratories in the examination of milk-samples for farmers are still being availed of and are much appreciated by owners desirous of a means of control. The mammitis-control scheme of the laboratory should be taken more advantage of by farmers as the value of hygienic measures in prevention cannot be given too much importance.

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Contagious Abortion.

This disease of cattle is in the same position as in former years. It would appear that a reduction in the number of outbreaks as compared with the previous season is to be recorded. The control of the disease must be based on hygienic measures adopted in the management of the dairy herd, the isolation of affected animals, and the furtherance of the principle of self-maintenance in regard to replacements in dairy herds.

The testing of blood-samples by the application of the agglutination test is of considerable importance to the owner of the herd and also to the officer who is investigating the disease on affected farms. The control measures to be adopted depend largely upon the result of the blood test showing the extent of the disease in any herd.

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Temporary Sterility.

This trouble has been on a level with previous years. The investigations in regard to the several aspects of the ætiology of the condition of delayed conception in dairy herds are being continued. There is no doubt that delayed conception, as a breeding problem for the farmer, is not due to any specific cause, the female factor, the male factor, the disease factor, and the nutritional aspect all requiring to be further investigated. After investigation of the history of the trouble on many farms at the present time suitable remedial measures can be suggested.

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Ergotism and "Fescue Poisoning."

In districts where tall fescue is liable to become a rank growth and allowed to form seed heads there is always the danger of animals being affected with ergotism when the farmers use such growth for stock during the winter months of scarcity. There is not the same danger when the fescue growth has been controlled by suitable grazing throughout the season.

* * * * *

Parasitic Disease in Young Cattle.

Parasitic gastro-enteritis and bronchitis still continue to be a problem for the producer who raises young stock. Many calves on dairy-farms

are lost annually from this disease, and many more are of weak constitution following a severe attack of worms. In many cases weaning takes place too soon or supplementary feed is not supplied to make up for the deterioration in the feeding-value of pasture during the autumn and winter. Better-developed calves with stronger constitutions would result from a more prolonged feeding with milk or other reasonable substitute, and in the rearing of good calves better feeding is the basis of success. The production of stronger, better-constitutioned yearlings would improve the disease position generally in many herds in the course of a few years.

* * * * *

Parasitic Disease in Sheep.

The control of parasitic disease in sheep during the past season has again proved to be very necessary if heavy losses are to be avoided. The unseasonable feed conditions for sheep throughout have made it difficult to carry over hoggets with any degree of immunity from loss. Hogget feeding and wintering is a more or less specialized branch of sheep-farming and unless farmers give special thought and attention to it the results are at times very discouraging. The provision of supplementary feeding in the way of hay, roots, ensilage (and in some cases oats and peas are available) reduces the risk of loss to a very marked extent. It is necessary also to provide a balanced ration wherever possible, as too much watery feed such as roots alone prove of doubtful value. Too much emphasis is often placed on the use of drenches of worm preparations without due attention to the feed conditions. In other cases, although the feed conditions are reasonable, drenching is totally neglected or left until the hoggets become weak and scouring takes place. The instructions given by field officers to drench early and repeat at intervals with a reliable drench such as the copper sulphate-nicotine mixture, and attention to the feed conditions are most satisfactory, and where carried out give very satisfactory results. It is pleasing to record that this drench is being quite generally used in the eradication of worms from infested stock.

* * * * *

Pulpy Kidney.

Reports indicate that in the Otago district the losses from this disease were generally below the average of the last two years. In a few instances, however, lambs of an older age were affected with the disease, and this also applied to some losses recorded in the Nelson district.

An extension of the vaccination of the pregnant ewe with a view to conferring immunity on the lambs through the colostrum was organized and carried out by Mr. Dayus, District Superintendent, Dunedin. Mr. Dayus reports: "In all, 2,608 ewes were vaccinated with a vaccine prepared at the Wallaceville Veterinary Laboratory. In addition, observations were maintained on a group of 1,141 ewes, which were vaccinated by farmers, in some cases without help, with a commercial entero-toxæmia vaccine purchased from the Commonwealth Serum Laboratories, Royal Park, Victoria. In all cases a suitable number of control ewes were reserved, which, with the vaccinated ewes, were depastured together. The results briefly show that in the group of 2,608 vaccinated ewes the losses of lambs from pulpy-kidney

disease were eight, whereas in the control group of 2,500 unvaccinated ewes the losses totalled eighty-four, or in other words the losses of lambs from vaccinated ewes were 0·306 per cent., whereas the loss of lambs from the control unvaccinated ewes was 3·36 per cent. In the second trial, using the commercial vaccine, the losses of lambs from 1,141 vaccinated ewes were 22, or 1·92 per cent., whereas the losses of lambs from 2,275 control ewes were 84, or 3·68 per cent."

* * * * *

Lymphadenitis.

Although the incidence of this disease in sheep is not so high in New Zealand as in some other countries, it is, nevertheless, a disease which, from a carcass and meat inspection point of view, requires to be kept in check to enable the export of these products to be carried out without any undue restrictions. It has been clearly demonstrated that the regular annual palpation of live sheep will detect affected animals and a continuance of this practice on infected properties over a few years leads to a marked reduction of the disease in infected flocks. Furthermore, the precautions, previously outlined, at shearing-time should be more seriously adopted by farmers in order to reduce the incidence of the disease in the carcass to a minimum. The chronic nature of the disease which allows it to remain undetected in many cases until the carcass is examined for export may account for a lack of interest. Affected carcasses are rejected for export.

* * * * *

Lice and Ticks.

The previously recorded system of inspection of flocks inaugurated in the Poverty Bay district has continued to give good results and has reduced the prevalence of lice-infested sheep exposed for sale. More care in dipping is being exercised, and more interest is being taken by the farmer.

The number of prosecutions for exposing lice-infested sheep for sale during the year shows clearly that much improvement is still desirable. There may be some excuse for men with small lots of sheep and no dipping facilities, but, generally speaking, the offenders are not confined to this class alone.

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Development of Pig Industry.

The development that has taken place in the pig industry during the last ten years is displayed by the following figures:—

Year.	Number of Sows.	Total Pigs killed.	As Baconers.	As Porkers.
1927	69,487	380,954	268,075	112,879
1928	83,103	476,828	237,960	238,868
1929	74,692	518,025	247,292	270,733
1930	61,706	515,428	255,758	259,670
1931	64,981	525,286	212,206	313,080
1932	75,409	474,094	207,096	266,998
1933	87,686	635,282	243,820	391,462
1934	98,299	784,952	313,135	471,817
1935	111,793	936,700	346,948	589,752
1936	116,058	1,077,883	427,178	650,705

Wallacéville Poultry Station.

This plant continues to render good service to the industry. The quality of the stock is being maintained, and the introduction of the fresh blood from New South Wales is proving beneficial. The demand for eggs for hatching-purposes, and breeding-birds, by both large and small poultry-keepers is on the increase. Five feeding-tests with some two hundred adult pullets were carried out during the year, and five similar tests with a different lot of birds are being carried out this year. The result of these tests should prove of interest and value to poultry-keepers.

* * * * *

Hill-country Deterioration.

The Superintendent of the Fields Division writes:—

There are two major projects which in the future will require to be given more consideration than has been the case in the past. I refer particularly to the problem of hill-country deterioration in the North Island and the regrassing of the depleted tussock areas of the South Island. The deterioration of hill country in the North Island is a most serious problem of ever-growing intensity, and it is obvious that if steps are not taken immediately to investigate the causes of its deterioration, and, if possible, to effect a remedy, much valuable land which hitherto had a relatively high stock-carrying capacity will be abandoned to fern and secondary growth. Already many settlers have had to abandon their holdings, and others are merely struggling along in a fight against almost overwhelming odds. It would appear that the problem is one largely bound up with the question of such settlers obtaining easy credit for the purchase of seeds, manure, fencing, and stock to combat the weed-intrusion. Large-scale experiments in which I envisage the possibility of the Department taking control of several farms would appear necessary to secure the fullest information of how to rehabilitate this class of country.

So far as the depleted areas of the South Island are concerned, it will be recognized that the large tracts of semi-barren country, particularly in Central Otago and the McKenzie Country, require the closest investigation with a view to increasing their carrying-capacity. At one time these areas carried a wealth of natural pasture affording an abundance of feed for sheep, but with the passing of time, due largely to overstocking, rabbit-invasion, and injudicious burning, the native pastures have been woefully depleted, and to-day large tracts of virtually barren areas exist in place of the excellent native pastures of by-gone days. The striking work of the late Dr. L. Cockayne, who conducted a series of experiments on the Dunstan Mountains, has given a lead to the method by which regeneration of the tussock areas may be effected, but further extensive work in this connection requires to be carried out. The possibility of introduction of grasses and other plants adapted to the soil and climatic conditions of the tussock areas has not yet been fully exploited, and this should be done at the earliest possible opportunity. Proposals to investigate these two major projects are in hand, and it is expected that during the coming season facilities will be forthcoming to fully investigate the position.

Feed-flavour Investigation.

The following practices are confidently recommended for improving cream-quality, including the reduction of feed flavour, and at the same time increasing production :—

(1) Never hard-graze pastures for long periods, particularly in the winter and early spring. Hard grazing weakens the rye-grass and encourages white clover. Very lenient grazing in the winter and early spring, on the other hand, strengthens rye-grass by increasing its root system and weakens clovers by smothering. A system of long spells between rapid but lenient grazings should be adopted. The adoption of recommendations as above to some extent alter the normal winter feeding of stock, as winter spelling of pastures can only be successfully carried out by commencing feeding out before it really becomes necessary.

(2) Another recommendation is to top-dress in April or May about four good pastures which have been adequately phosphated and limed with sulphate of ammonia at 1 cwt. or 1½ cwt. per acre and lime at 3 cwt. per acre. These fields should be closed to stock and should be only lightly grazed in the late winter and early spring.

(3) Avoidance of the use of "night paddocks" as far as possible should be adopted, because permanent "night paddocks" slow up the "phosphate-clover-stock-nitrogen-rye-grass" process.

(4) In periods of strong feed flavour the most grassy pastures should be grazed during the day and those containing most clover during the night. In addition, cows should be kept off the clover pastures for about four hours prior to afternoon milking.

(5) Where possible, good hay should be fed when feed flavour is prevalent.

(6) At all times, but particularly in periods of strong feed flavour, attention should be paid to cleanliness and to the cooling of the cream.

* * * * *

Artificial Fertilizers.

The practice of top-dressing pastures is a very commendable one, and all officers of the Fields Division are fully alive to the value of bringing about this practice to a greater extent than has been the case in the past, even although an increase in the amount of fertilizer and lime used is being shown from year to year.

In the South Island a definite tendency has been taking place to use basic superphosphate instead of superphosphate for pasture top-dressing. The advocates of this change-over affirm the fact that the results obtained justify the procedure, but, apart from the rights or wrong of this claim, it would definitely appear illogical to first produce a water-soluble phosphate which in the past has proved to be of the highest value for top-dressing purposes and then immediately convert it into a di-calcic form of less solubility. It has to be admitted that southern pastures in the main require liming, and, provided that top-dressing with super-

phosphate is preceded by liming where necessary, there would appear to be little reason in advocating basic superphosphate in place of superphosphate for top-dressing purposes. It is obvious, however, that the claims made for basic superphosphate in preference to superphosphate require the closest investigation, as does the place of basic slag and various citrate soluble phosphates, and investigations in this connection are taking place and will be extended.

* * * * *

Creamery Butter.

The Auckland Province continues to maintain its lead in the production of creamery butter, and of the 151,436 tons sent forward for grading, 105,287 tons were graded at the Auckland port, 119,114 tons, or 78·65 per cent., being classed as finest, 30,800 tons, or 20·34 per cent., as first, and 1,522 tons, or 1 per cent., as under first grade. The arrangement whereby all butter of lower quality than first grade is disposed of through a channel which prevents its coming into competition with the higher grades has been continued. On the whole, quality has shown a slight improvement, the average grade for the year being 93·266, as compared with 93·158 for the previous twelve-months.

The scale of prices under the Government's guaranteed-prices scheme has had a bearing on quality, and during the present season butter-manufacturers have aimed at a finished article on which the premium above the basic price is being paid. In addition, some of the advance in quality may be attributed to improved shed, plant, and farm conditions, as well as improvements in respect of dairy factories and plant brought about through the Labour Department's financial assistance by way of subsidy.

Complaints were confined principally to feed flavours and to faulty control of neutralization of acidity in cream. The practice of using starters in buttermaking is extending, and considerable difference of opinion still exists as to the advisability of using starter in the manufacture of butter. It would appear that proper conditions of preparation and considerable experience and skill in the use of starter are necessary before the practice can be safe and success assured.

The growing number of reports from the Division's officers in Britain in respect of foreign matter in dairy-produce, more particularly butter, gives cause for grave concern. The matter has been taken up with dairy companies, but unless the position improves severe steps would appear justified to remove grounds for further complaint. The majority of reports received indicate carelessness rather than accident, and in properly equipped and conducted factories there should be little excuse for either.

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Cheese.

Some 89,996 tons of cheese came forward for grading, and of this total, 18,806 tons, or 20·90 per cent., were graded as finest, 68,927 tons, or 76·61 per cent., as first, and 2,233 tons, or 2·48 per cent., as under first.

Taken as a whole, cheese-quality for the period under review must be regarded as fairly satisfactory, showing a slight improvement over the previous year. The principal faults are still openness and mould. Starter troubles were less general, though still a major problem in connection with cheese-manufacture. Apart from openness and mould, adverse reports from our London officers relate chiefly to a lack of Cheddar character and an inclination to bitterness, with harsh, mealy bodies. Broadly summed up, however, London reports were encouraging and indicate that New Zealand cheese is well received in Britain and improving its reputation from year to year.

With regard to mould, an experiment was conducted at the Wellington grading-stores to endeavour to ascertain the effect of handling on mould-development, it being considered by some that rough handling of the cheese in the factories was a likely cause. The experiment gave inconclusive results, but served to indicate that if conditions in the curing and storage rooms were properly controlled, mould was unlikely to penetrate even a cracked cheese.

* * * * *

Growing of Passion-fruit.

The growing of passion-fruit on a commercial basis has been receiving considerable attention during recent years, more particularly in the North Auckland district. There has, however, been a falling off in the quantity of fruit produced during the past two seasons, due largely to the want of co-operation in the marketing of the produce. Another factor that has contributed to the past season's light crop is the incidence of disease, which demonstrates that it is essential for growers to carry out systematic spraying of the vines, this phase of the work having hitherto been practically neglected.

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Te Kauwhata Horticultural Station.

The continuous moist weather conditions were favourable to the growth of grass and enabled more than the usual number of stock to be pastured for fattening purposes. From the sales of live-stock, wool, and skins, £401 18s. 5d. was received.

Approximately two and a half acres of scrub and wattle were cleared and sown in grass prior to being planted in vines and three and a half acres of hay harvested for stock-feeding purposes.

A late cold spring and a cool summer retarded growth in the vineyard, and this, in addition to the damage caused by the heavy storm of the previous year, resulted in the season's crop of grapes being considerably below the average. It is estimated that as a result of these unfavourable conditions the quantity of wine produced will not exceed 9,000 gallons, which is a considerable reduction on last year's figures. There has been an increased demand for wine manufactured at the Station, the total sales for the year amounting to 15,125 gallons which realized £8,031. Orders for vines and vine-

cuttings showed an increase, and large quantities were sent out during the season to all parts of the Dominion. The financial position of the Station is satisfactory, receipts exceeding the general working-expenses by some £3,000.

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HONEY EXPORTS.

Quantities and values of honey exported from the Dominion during the last five years ended 31st March are as follows:—

	Cwt.	Value. £
1933	2,005	7,014
1934	7,342	23,784
1935	5,427	17,844
1936	10,446	34,258
1937	7,774	24,658

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DOMINION SHEEP STATISTICS AND CURRENT SLAUGHTERINGS.

THE number of sheep (including lambs) in the Dominion on the 30th April, 1937, totalled 31,305,818 in land districts as under :—

North Auckland ..	1,118,738	Marlborough ..	1,130,048
Auckland	2,072,366	Westland ..	82,311
Gisborne ..	2,343,300	Canterbury ..	5,874,467
Hawke's Bay ..	4,127,594	Otago	3,961,751
Taranaki	712,020	Southland ..	2,650,908
Wellington ..	6,791,678		
Nelson	440,637	Dominion total	31,305,818

The monthly figures of slaughterings at meat-export slaughterhouses and abattoirs since the date given above have been tabulated, and for the period of five months, May to September inclusive, the slaughterings are as follows :—

SLAUGHTERINGS OF STOCK AT MEAT-EXPORT SLAUGHTERHOUSES AND ABATTOIRS FOR THE FIVE MONTHS, MAY TO SEPTEMBER, 1937.

—	Cattle.	Calves.	Sheep.	Of which Ewes.	Lambs.	Swine.
NORTH ISLAND.						
Meat-export slaughterhouses—						
Auckland	58,992	458,027	31,568	14,637	90,844	89,874
Poverty Bay – Hawke's Bay	14,759	31,579	83,842	20,479	98,049	12,083
Taranaki-Manawatu ..	47,389	196,304	68,760	32,018	148,365	48,365
Wellington-Wairarapa	18,148	21,962	84,808	31,680	89,794	14,680
Totals	139,288	707,872	268,978	98,814	427,052	165,002
Abattoirs	54,448	21,440	155,362	93,089	9,808	36,934
North Island totals ..	193,736	729,312	424,340	191,903	436,860	201,936
SOUTH ISLAND.						
Meat-export slaughterhouses—						
Nelson-Marlborough ..	169	6,456	287	330	22,893	2,475
Canterbury	9,577	21,339	123,408	102,447	549,769	14,960
Otago-Southland ..	6,898	24,828	37,238	33,975	417,721	1,781
Totals	16,644	52,623	160,933	136,752	990,383	19,216
Abattoirs	26,792	5,401	107,599	51,109	5,901	11,892
South Island totals ..	43,436	58,024	268,532	187,861	996,284	31,108
Dominion.						
Meat-export slaughterhouses	155,932	760,495	429,911	235,566	1,417,435	184,218
Abattoirs	81,240	26,841	262,961	144,198	15,709	48,826
Grand totals ..	237,172	787,336	692,872	379,764	1,433,144	233,044

Quarterly returns are received for killings at ordinary slaughterhouses—*i.e.*, rural slaughterhouses—and for the whole Dominion the killings at these places for the first quarter ended 30th June, 1937, amount to :—

Cattle	22,513	Lambs	2,057
Calves	637	Pigs	7,311
Sheep	54,253		

PEDIGREE-SOW RECORDING.

FIRST ANNUAL REPORT FOR THE YEAR ENDING 31ST AUGUST, 1937.

UNDER the pedigree-sow recording scheme commencing from 1st October, 1936, thirty-eight breeders made use of the departmental service, placing 186 sows under test, and getting 131 completed records. The reasons for the uncompleted records are as follows: Less than four piglets alive, 26; sow dead or not in-pig, 13; withdrawn for other reasons, 10; not weighed, 5. The illness of one of the departmental officers explains the last item. Of the 131 completed records, 28 litters weighed less than 200 lb., 54 between 200 lb. and 300 lb., and 49 were better than 300 lb. at eight weeks.

Twenty-six breeders made use of the Manawatu-Oroua Pig Recording Service, getting 126 completed records. Of the completed records, 35 litters weighed less than 200 lb., 53 between 200 lb. and 300 lb., and 38 were better than 300 lb. at eight weeks old.

Eight breeders made use of the Waikato Pig Recording Club's service, getting 59 completed records out of 72 sows. Of the completed records, 13 litters weighed less than 200 lb., 26 between 200 lb. and 300 lb., and 20 better than 300 lb. at eight weeks old.

These figures converted to percentages give 24 per cent. of all litters recorded at less than 200 lb. at eight weeks, 42 per cent. between 200 lb. and 300 lb., and 34 per cent. better than 300 lb. weight at eight weeks.

The average performances of the different breeds and of all sows recorded is set out in the following table:—

Table 1.

Breed.	Number of Sows.	Pigs born.	Pigs weaned.	Average Number of Piglets per Sow.		Average Weight per Piglet	
				Born.	Weaned.	At three Weeks.	At eight Weeks.
						lb.	lb.
Large Black ..	39	376	268	9·6	6·9	11·82	36·39
Tamworth ..	162	1,509	1,125	9·3	7·0	12·15	38·05
Large White ..	54	639	455	10·8	8·4	12·48	38·66
Berkshire ..	73	653	528	9·0	7·2	10·97	33·98
All breeds ..	328	3,177	2,376	9·7	7·3	11·90	36·50

It is difficult to decide how this information can now be used to best advantage—on the one hand the producers of commercial pigs are anxious to know where prolific and thrifty pigs may be obtained; on the other, it is hardly fair at this early stage to publish all results in detail, since many excellent sows have failed to show their worth, owing to unfortunate happenings that may possibly be avoided in the future. With these considerations in mind it has been decided to publish, under the owner's name, the herd-book number of every sow that attains a certain standard.

Five grades, or standards, have been adopted, as follows :—

Table 2.

Grade.	Litter-weights (Pounds) at	
	Three Weeks.	Eight Weeks.
1	Greater than 120 ..	And 360
2	Greater than 100 ..	And 300
3	Greater than 90 ..	And 270
4	Greater than 80 ..	And 240
5	Greater than 70 ..	And 210

Many sows have produced a litter of 70 lb. at three weeks, but failed to do them well up to eight weeks; others have done poorly up to three weeks and done well up to eight weeks. This is a matter for the owner, and since each owner has his records in detail he can take the necessary action to get his sows qualifying if he thinks it desirable. The dual standard may not be a just one, but it seems to be a very desirable one and is simpler than those based on the number of pigs and the weight per piglet at different ages.

In the statement following, the name and address of the breeder is given, followed by the breed and herd-book number of his sow or sows. The single number after each sow denotes the grade of litter produced. This can be interpreted from the previous table. The herd-book number of the sow serves not only to identify the sow, but gives as well a rough indication of her age, for which some allowance should be made when these figures are being considered. Sows tend to have poorer litters after the sixth or seventh. The herd-book numbers allotted to the various breeds from 1932 to 1936 inclusive will be found at the end of this publication. A sow's number appears in the herd book, as a rule, about one year after the sow is born.

List of Graded Sows.

Barnett, A. L., Leeston, Canterbury ..	B. 10329, 5.
Berry, A. F., and Sons, Rockville, Collingwood	T. 6011, 2; T. 6013, 5; T. 4718, 5.
Boland, R. A., Crystal Brook, Longford, Nelson	L.B. 872, 2.
Candy Bros., Pokuru R.D., Te Kawa ..	L.W. 4518, 2; L.W. 4670, 3; L.W. 4362, 3; L.W. 4504, 4.
Canterbury Agricultural College, Lincoln ..	T. 6211, 1; T. 6212, 2; T. 8949, 5; L.W. 4621, 1; L.W. 4765, 2; L.W. 4131, 2; L.W. 4430, 3; B. 10823, 2; B. 11716, 2; B. 11316, 5.
Telford, T. W., and Sons, Oakura, Taranaki..	T. 8034, 3; T. 7349, 5; T. 5162, 5.
Unwin, S., Stoneycroft, Winchester, South Canterbury	B. 10387, 2; B. 10387, 2.
Warnock, Mrs. E. M., Hunt's Road, Owaka, Clutha	T. 7645, 4.
Wesley College, Paerata, Pukekohe ..	L.W. 4353, 3; B. 10844, 5.
Whitelock, D. P., Normanby, Taranaki ..	L.B. 892, 4; L.B. 760, 5.
Baxter, A. J., Aorangi, Feilding	T. 4156, 2; T. 4156, 5.

List of Graded Sows—continued.

Buchanan, D., Tiakatahuna	L.W. 2951, 2; L.W. 2952, 5.
Burmeister, O., Kairanga R.D., Palmerston North	B. 8528, 3; B. 8528, 5.
Cheetham, S.	L.B. 1539, 5.
Cheltenham Dairy Co., Feilding	T. 3304, 1; T. 6763, 1; T. 6761, 2; T. 6764, 2; T. 8681, 3; T. 3304, 5; T. 6761, 5; B. 9344, 3; B. 8578, 4; B. 10297, 5.
Christensen, O., Tokomaru	L.B. 1107, 1; L.B. 1540, 4; L.B. 1314, 5.
Clausen, O. V., Foxton Line, Palmerston North	B. 9565, 5.
Davison, W.	L.W. 4215, 2.
Fieldhouse, H. E., Rongotea	B. 10811, 2; B. 10811, 4; B. 10099, 4; B. 10699, 5; T. 2448, 3.
Feilding High School, Feilding	T. 4514, 3; L.B. 1519, 4; L.W. 4599, 5.
Hansen, N. E., Palmerston North	T. 6425, 5.
Hunt, C. S., Glen Oroua	T. 5625, 1; T. 3938, 2; T. 5511, 2; T. 8158, 3; T. 3327, 4; T. 3937, 5; T. 5625, 5; B. 11570, 4.
Johnston, D. T., Kauwhata	T. 7573, 4.
Keiller, B. E., Palmerston North	L.W. 3552, 1; L.W. 4459, 1; L.W. 2916, 3.
Leamy, P., Kairanga, Palmerston North	T. 3928, 4.
Lyons, G., Kopane R.D., Palmerston North	B. 10188, 5.
Massey Agricultural College, Palmerston North	T. 7059, 2; T. 7261, 2; T. 7263, 3; T. 7201, 4; T. 3015, 4; T. 3101, 4; T. 7059, 4; T. 8834, 4; T. 8518, 4; T. 8833, 5; T. 8836, 5; T. 8301, 5.
Pedersen, N., Kauwhata, Palmerston North	L.B. 1109, 2; L.B. 1109, 2.
Price, R.	T. 7516, 2.
Russell, J. A., Blythewood, Gillespie's Line, Palmerston North	B. 11369, 4; B. 10035, 5.
Scott, W. C., Glen Oroua	T. 5274, 3; T. 7100, 4; T. 8479, 5.
Childs, J. F., Champion Road, Richmond, Nelson	L.W. 3752, 2.
Clark, A. S., Pokuru, Te Kawa	T. 5714, 1; T. 5714, 2.
Cloke Bros., Lepperton, Taranaki	B. 11082, 2; B. 10368, 3.
Golder, G. A., Nireaha, Eketahuna	T. 7375, 2.
Gillett, G. E., Sefton, North Canterbury	T. 6176, 2; T. 6775, 2; T. 7729, 2; T. 7729, 4; T. 7730, 4; T. 8295, 4; T. 4995, 5; T. 4994, 5.
Griffin Bros., Richmond, Nelson	T. 7755, 5.
Guddop, A. R., Cowling Road, New Plymouth	T. 6747, 2; T. 6939, 3; B. 10830, 3.
Hoey, J., Kama, Whangarei	T. 5349, 1.
Larsen, O. C., Umutaoroa, Dannevirke	B. 10163, 2; B. 11409, 4; B. 11102, 4; B. 11101, 5.
Lepper, M. H., York Road, Midhirst, Taranaki	L.W. 4550, 1; L.W. 2687, 1; L.W. 3826, 1; L.W. 3825, 2; L.W. 2688, 2; L.W. 4549, 2; L.W. 4647, 4.
Mellsop, R., Matatoki, Thames	T. 7954, 5.
Ogle, F., Austin Road, Normanby, Taranaki	T. 7194, 2; T. 5536, 4; T. 5536, 5; T. 3209, 5.
Oliver, Mrs. A. B., Kelly Road, Lepperton, Taranaki	L.B. 1157, 2; L.B. 1404, 3; L.B. 1271, 3; L.B. 1402, 4; L.B. 1271, 4; L.B. 1158, 5.
O'Sullivan, A. M., Cardiff, Taranaki	L.B. 962, 1; L.B. 1387, 5.
Otago Central Pig-breeders' Club	L.W. 4641, 2; L.W. 4641, 4.
Preston, H. H., Harrisville	L.W. 3646, 4.
Rayner Bros., Patumahoe, Franklin	L.W. 4726, 4.

List of Graded Sows—continued.

Rose, V. C., Otira R.D., Invercargill ..	L.B. 1234, 4.
Simpson, J. S., Southbridge, Canterbury ..	T. 8498, 2; T. 6699, 5.
Stewart and Kerr, Onewhero, Tuakau ..	T. 7407, 1; T. 7408, 5; T. 8693, 5; B. 10306, 5.
Stratford Technical High School, Stratford..	T. 7921, 1; T. 7046, 2.
Suter, E., Waiau Pa, Pukekohe	T. 4450, 2; T. 9029, 5.
Taylor and Sons, Ngaere R.D., Stratford ..	B. 10772, 1; B. 10772, 2; B. 11808, 4.
Whitelock, G. M., Newbury, Palmerston North	L.W. 2486, 2; L.W. 4540, 2; L.B. 1265, 2; L.B. 1245, 2; L.B. 1320, 2; L.B. 508, 4.
Williams, W. M., Fitzherbert West R.D., Palmerston North	T. 7721, 2; T. 8223, 2.
Annett, H. E., Matangi, Hamilton ..	T. 4935, 1; T. 6290, 2; T. 6290, 2; T. 4935, 2.
Barton, G. H., Whatawhata, Hamilton ..	T. 5784, 3; T. 4557, 3; T. 7108, 4; T. 5785, 5.
Burwen, Ltd., Te Rapa, Hamilton ..	T. 8026, 2; T. 8461, 3; T. 8382, 4; T. 8210, 4; T. 5494, 4; T. Wallinger Sunbeam, 5; B. 11630, 1.
Chilcott, R., Te Rapa, Frankton Junction ..	B. 9705, 2; B. 10998, 2; B. 10352, 3; B. 10349, 3; B. 11307, 5; T. 3570, 2; T. 3570, 2.
Jones, E. J., Eureka, Hamilton	T. 6286, 1; T. 6349, 3; T. 6286, 4; T. 8307, 4; T. 8462, 4; T. 8156, 4; T. 8309, 5.
Masters, L., Eureka, Hamilton	L.B. 1417, 4.
Parsons, J. E., Pukeroro R.D., Hamilton ..	L.W. 4144, 1; L.W. 4571, 1.
Porrit, G. D., Pukeroro R.D., Hamilton ..	L.W. 4154, 1; L.W. 4582, 1; L.W. 4156, 1; L.W. 4156, 1; L.W. 4514, 1.

Herd-book Numbers.

Year.	Berkshire.	Large White.	Tamworth.	Large Black.
1936 ..	11858	4740	8883	1513
	11001	4557	7764	1348
1935 ..	11000	4556	7763	1347
	10292	4242	5879	1131
1934 ..	10291	4241	5878	1130
	9740	3707	4191	874
1933 ..	9739	3706	4190	873
	9259	3114	3323	752
1932 ..	9258	3113	3322	751
	8851	2256	2900	603

Montgomery red clover has done very well where used in Southland, particularly as a haying proposition. Where included in permanent pasture mixtures, however, very little is seen after the third year. A noticeable feature is that this plant is not grazed by rabbits, probably on account of its hairy leaf.

BORERS IN FRUIT-TREES.

L. J. DUMBLETON, Assistant Entomologist, Division of Entomology, D.S.I.R., Nelson.

THE incidence of injury to fruit-trees caused by insects boring into the roots, stem, or branches is not of a very widespread or serious nature in New Zealand, except perhaps in the case of citrus trees. Nevertheless, a number of insects have been recorded as boring in fruit-trees, and it is the purpose of this note to furnish what information is available on their habits and on possible methods of controlling them.

The insects recorded here are native species. One is the caterpillar of a moth and the others are the grubs or larvæ of longhorn beetles. A distinction may be made between those insects which bore into living wood, thus doing serious damage to the tree, and those which bore in wood which is dead and dry and do not usually extend their depredations into the green wood. In the first group come *Charagia virescens*, *Oemona villosa*, and possibly also *Navomorpha lineatum* and *Navomorpha sulcatum*. In the second group come *Xyloteles griseus* and *Xyloteles laetus*.

DESCRIPTION AND HABITS OF THE INSECTS.

The ghost moth (*Charagia virescens*) is the largest of the native moths, having a wing span of 4 in. or more. The general colour is green with paler and darker markings. The moth itself is not often seen unless it flies into lights in a house. Moths are flying from September to November. The habits of the insect are not well known, but it is assumed that the eggs are laid on the ground and that the young caterpillars hatching from them climb the trees and commence boring in a favourable position. The duration of the caterpillar stage is probably more than three years, and it grows to a length of 3 in. The presence of this insect may readily be diagnosed by the silken web or curtain, resembling the bark in colour, which conceals the mouth of the burrow. Under this is a shallow excavation, and from it a burrow leads off on each side round the side of the limb, while a third burrow extends inward toward the centre of the limb and then vertically downward for perhaps 6 in. In the case of well-grown caterpillars these tunnels may be $\frac{1}{2}$ in. in diameter. The insect, whether in the caterpillar or chrysalis stage, is usually to be found in this vertical burrow. The species is not present in the South Island. A large number of native and exotic trees are attacked by this insect. Injury to fruit-trees is probably more common in districts where patches of bush or native vegetation are close to the orchards. Cases of damage to apple, peach, nectarine, and lemon trees have been recorded.

The Lemon-tree Borer (Oemona villosa).—This longhorn beetle is sometimes known as *Aemona hirta*. The beetle has the long antennæ which are characteristic of longhorn beetles. The body measures up to 1 in. in length and is more or less parallel sided. The general colour is brownish with a clothing of short, golden hair. The life-history of this insect has not yet been carefully studied. The

beetles have been noted to emerge in the spring. The female lays her eggs on dead or exposed wood, such as a branch stub or a place where the bark has been removed. The eggs are affixed to the wood and the young grub bores through the egg-shell and into the wood. Having gained entry through the dead wood, the grub then bores into the living or green wood and commences to make an extensive burrow. The duration of the grub stage is not known, but it is probably more than one year. The grub is similar in appearance to a small "huhu" grub, and when fully grown it may be slightly over an inch in length, cylindrical, white or creamy in colour, and without well-developed legs. Besides boring up or down the centre of the branch the grub frequently cuts a circular burrow round it under the bark and so weakens the branch that it bends or breaks easily. The presence of the insect may be detected by small holes in the bark through which grass or wood particles are ejected. When ready to pupate or transform to the chrysalis stage the larva plugs the tunnel in front and behind it with shreds of wood. In this cell it changes to the chrysalis stage, and a few weeks later the bettle emerges. The grubs of this species are difficult to separate from those of *Navomorpha*, although the beetles are quite distinct. The grubs are found boring in a large number of native and introduced trees and they have been recorded from apple, lemon, and almond trees. Injury by this species seems to be of common occurrence in lemon trees.

The Douglas Fir Longhorn (Navomorpha lineatum).—This longhorn beetle is similar in habits to the preceding one. The beetle is easily distinguished. It is dark red in colour, with white stripes. The length of the body is about $\frac{3}{4}$ in. The beetles are flying from November to January. The grub is similar to that of *Oemona*, but usually longer and more slender. The fully developed larvæ may be $1\frac{1}{2}$ in. in length. The method of gaining entry and the nature of the burrows are similar to that of *Oemona*. The grub of this insect bores into living wood, whereas that of a related species, *Navomorpha sulcatum*, usually bores only in dead wood. *N. lineatum* commonly damages Douglas fir in the North Island, the eggs often being laid on the wounds made by oviposition scars of the cicada. While there is no definite record of the species from fruit-trees it is felt that the species was concerned in a large number of cases of injury which have been attributed to *N. sulcatum*, owing to their similarity in the grub stage.

The Pine Longhorn (Navomorpha sulcatum).—This beetle is generally similar to, but smaller in size than, the preceding one, reaching about $\frac{1}{2}$ in. in body length. The red colour is not so distinct and the white stripes occupy relatively more space. The beetles have been recorded as emerging in August. The egg-laying habits are similar to those of the preceding two species, but the grubs seem to confine their activities to dead, dry wood. The duration of the grub stage is not known. The grubs when fully developed may be $\frac{3}{4}$ in. in length. As far as is known the species does not usually bore in living wood and does not make the circular tunnels under the bark which weaken the branches. This species is found in a number of native and exotic trees and has been recorded from apple and almond trees.

Xyloteles griseus has been called the fig longhorn. The beetle is $\frac{7}{16}$ in. in length, brown in colour, with two or three small patches of yellow hairs on each side of the body. The beetles emerge in December and January. The female, with her mandibles, bores a hole in the bark and inserts her egg between the bark and the wood. The grubs bore at first between the bark and the wood, but later enter the wood. The activities of the grub are confined to dead, dry wood. The length of the grub stage is not known. The grub, when fully fed, is slightly over $\frac{1}{2}$ in. in length. It transforms to the chrysalis in a cell in the burrow. This insect bores in a number of native and exotic trees and is sometimes found in mummied apples.

Xyloteles laetus is a closely related species of similar appearance and habits to the preceding one.

Methods of Treatment.

It is not known whether there are any conditions which predispose a fruit-tree to attack by *Charagia*. It is possible that it may attack perfectly healthy trees. In the case of the longhorn beetles *Oemona* and *Navomorpha*, however, it is known that the point of attack is through dead wood in a pruning-scar, branch stub, or wound. In cases where these insects are commonly present in an orchard it will be advisable to remove all dead wood and seal pruning scars and wounds with some material such as white lead or grafting wax.

Injury by *Charagia* may be readily diagnosed by the silken curtain which covers the entrance to the burrow. In most cases it will be possible to destroy the caterpillar or pupa by probing the burrows with a copper wire. When the operator is satisfied that the caterpillar has been destroyed the openings of the burrows may be sealed with putty or grafting wax and the wound painted over with white-lead. Whenever it is possible, the damaged wood should be cut out of the tree, but it may not be possible to do this in the case of *Charagia*, which is commonly found in the trunk or in large branches.

The burrows of the longhorn beetles *Oemona* and *Navomorpha* are frequently so twisted that it may be impossible to kill the grubs by probing with a copper wire. These two insects commonly attack the smaller branches, and damaged wood may often be cut out. Where it is not possible to cut out the infested wood or to kill the grub *in situ* with a copper wire it may be necessary to inject some insecticide into the burrow. A number of materials have been used for this purpose, but the use of many of them is often followed by injury to the tree, and until more information is available on the effect of the insecticide on the tree it is best to avoid this method of treatment. Calcium and potassium cyanide seem to be definitely unsafe to use as they may kill the cambium and bark above and below the point of application, when injected into a hole or applied to exposed wood. Para-dichlorobenzene also has been reported as injuring trees. These substances mixed with various oils are used to some extent in the United States of America for the control of a longhorn beetle in apple, but they are not applied to exposed wood or injected into the burrows. No information exists on the effect of

carbon bisulphide when injected into the burrows. The use of kerosene and petrol is sometimes advocated for killing grubs, but as these may have a toxic effect they had better not be used. Probably the safest type of insecticide to use is a plant product such as nicotine or derris. Of these two the nicotine is probably more efficient as it may act as a fumigant in cases where the liquid does not actually come in contact with the grub in the burrow. Even in the case of nicotine it is possible that it may have some toxic effect on the plant when injected into the burrows of the grubs.

PRICE-LIST OF WINES

made at

TE KAUWHATA HORTICULTURAL STATION.

WINE IN CASE.

(A case contains 12 reputed quarts—2 gallons.)

Delivery ex Departmental Store, Auckland, Wellington, Christchurch, and Dunedin.

FRONTIGNAC (sweet red)	30s. per case.
MADEIRA (sweet white)	30s. per case.
ASSORTED CASES OF THE ABOVE	30s. per case.

Delivery f.o.r. Te Kauwhata.

FRONTIGNAC (sweet red)	30s. per case.
MADEIRA (sweet white)	30s. per case.
CLARET (dry red)	25s. per case.

(Any assortment of the above can be packed to a case if required.)

WINE IN BULK.

(From Te Kauwhata only.)

FRONTIGNAC and MADEIRA can be supplied in bulk if required, provided suitable containers are supplied by the purchasers, but not otherwise. (Bottles not accepted; kegs or jars only.) Freight on containers forwarded for filling must be prepaid. Bulk rates are as follows:—

2 gallons	10s. per gallon (£1).
5 gallons	9s. 6d. per gallon (£2 7s. 6d.).

(Rates for larger quantities supplied on application.)

PLACING OF ORDERS, AND CONDITIONS OF SALE.

Orders should be forwarded to any one of the following: Manager, Horticultural Station, Te Kauwhata; Director, Horticulture Division, Department of Agriculture, Wellington; District Chief Clerk, Department of Agriculture, Auckland,; District Clerk and Accountant, Department of Agriculture, Christchurch and/or Dunedin.

Minimum quantity sold, 2 gallons. Cheques payable to "Department of Agriculture," and crossed "Public Account." Orders cannot be accepted unless accompanied by a remittance covering the price of the wine, and the exchange when drawn on banks outside Auckland, Wellington, Christchurch, and Dunedin. All freight to flag stations and ports beyond the railway must be prepaid. Under the Licensing Amendment Act, 1914, wine cannot be sent into a no-license area excepting on an "order signed by and stating the address and occupation of the purchaser thereof."

INTERPOLLINATION OF BRASSICAS.

ITS SIGNIFICANCE IN RELATION TO SEED-PRODUCTION.

R. A. CALDER, Agronomy Division, Lincoln.

THE intercrossing which may take place between such brassica forms as rape, turnips, and swedes is a matter of some concern to growers who raise these crops for seed and to the merchants who contemplate handling this seed in commerce.

An investigation relative to this phase of seed-production was conducted by the Agronomy Division for the purpose of attempting not only to determine the propensity the three forms have for cross-fertilization, but also to indicate the influence of such on the immediate progeny.

CROSS-FERTILIZATION STUDIES.

Rape, turnips, and swedes each belong to distinct species or subspecies, and, although to some extent capable of self-fertilization, set seed more freely consequent upon cross-fertilization between individuals of the same species.

Cross-fertilization may also operate in certain instances between distinct species. Sutton(1), in reference to interspecific crosses, which he himself carried out, proved that "while no variety derived from *Brassica oleracea* (cabbage, thousand-headed kale, kohl rabi) was affected by the pollen of rape, swede, or turnip, and *vice versa*, yet all types of *B. oleracea* would freely intercross between themselves, and this was equally true of many varieties of rape, swede, and turnip."

Roemer(2) crossed swedes ("*Rutabaga - Brassica Napus rapifera*") with kales and cabbages (*B. oleracea*). Fertile hybrid plants were obtained when the swede was used as the female parent; no successes were secured from reciprocal crosses.

Nelson(3) mentions the work of a number of investigators who acknowledge the ability of rape, turnips, and swedes to intercross, but from his own work concludes that differential fertility is to be found between these forms.

The evidence obtained from trials conducted by the Agronomy Division is in accordance with the views of Sutton and Nelson.

The forms used in the investigations were:—

(1) Rape (*Brassica napus* L.).
(2) Turnip, white flesh (*B. rapa* L.).
(3) Swede, yellow flesh (*B. napobrassica* Mill.).
(4) Wild turnip (*B. campestris* L.).
(5) Chou moellier or marrow-stemmed kale (*B. oleracea* L.). This was included as it is an important farm crop belonging to the species *B. oleracea*.

These were cross-pollinated reciprocally by hand; wild turnip was used as the male parent only. The results are recorded in Table I.

Table I.—Shows the Response in Number of Pods formed and in Number of Seed set due to Interpollination of some Brassica Species.

Female Parent.	Male Parent.	Flowers pollinated.	Number of Pods formed.	Number of Seed set.	Percentage of Pods set.	Average Number of Seed per Pod.	Appearance of Seed.
Giant rape ..	Turnip ..	40	34	41	85·0	1·2	Well developed, good colour
	Swede ..	96	69	767	72·0	11·1	Ditto.
	Wild turnip ..	30	20	80	66·6	4·0	,,
	Chou moellier	56	23	0	41·0	0	..
Broad-leaf Essex rape	Turnip ..	42	31	431	73·9	13·9	Well developed good colour.
	Swede ..	65	58	932	89·3	16·1	Ditto.
	Wild turnip ..	31	22	77	71·0	3·5	,,
	Chou moellier	18	0	0	0	0	..
Turnip ..	Giant rape ..	27	16	154	59·3	9·5	Shrivelled, reddish colour; tendency to germinate in pod; seed-coats split.
	B.L.E. rape ..	32	19	277	59·4	14·6	Ditto.
	Swede ..	192	140	1,021	73·0	7·3	,,
	Wild turnip ..	35	35	373	100·0	10·7	Well developed, good colour.
	Chou moellier	94	0	0	0	0	..
Swede ..	Swede ..	1,048	768	12,441	73·3	16·2	Well developed, good colour.
	Giant rape ..	96	86	1,659	89·6	19·3	Ditto.
	B.L.E. rape ..	103	93	1,945	90·2	20·9	,,
	Turnip ..	169	104	1,358	61·6	13·0	,,
	Wild turnip ..	39	27	71	69·2	2·6	Most well developed, good colour, some shrivelled.
	Chou moellier	60	23	0	38·6	0	..
Chou moellier or marrow-stem kale	Chou moellier	255	162	3,189	63·6	19·7	Well developed, good colour.
	Self-pollinated	281	127	246	45·2	2·0	Ditto.
	Giant rape ..	64	23	0	36·0	0	.
	B.L.E. rape ..	51	16	0	31·2	0	.
	Turnip ..	89	57	0	64·0	0	.
	Swede ..	191	75	0	39·3	0	..
	Wild turnip ..	43	5	0	11·6	0	..

Comments on Table I.

(1) It may be noted that some seed has been obtained from all crosses, with the exception of those where chou moellier has been used as one of the parents. Rape, turnip, and swede may be readily cross-fertilized.

(2) With seed or rape as the mother plant the seed harvested was well developed and of a good, dark colour; with turnip as the mother plant the seed was shrivelled, of a poor reddish colour, and tended to germinate in the pods; the seed-coat in many cases was split.

Somewhat similar observations were recorded by Sutton and Nelson.

(3) In some of the chou moellier crosses pods developed, but contained no seed. This fruitfulness accompanied by sterility is by no means unusual. Nelson draws attention to the occurrence and terms the seedless fruits "false pods."

(4) Wild turnip crosses readily with all forms excepting chou moellier. The seeds per pod are generally few, but they are well developed.

(5) Chou moellier exhibits some degree of sterility when selfed. Crossing resulted in 19·7 seeds per pod, selfing in 2·0 seeds per pod.

These results were obtained when the different types were artificially interpollinated. As it was of interest to determine whether cross-fertilization could occur naturally, the following procedure was adopted:—

Natural Cross-pollination.

Rape, turnip, and swede plants were grown in close association, and for a period all flowers, other than those covered subsequent to hybridization, were exposed and available for interpollination; this

was possible between members either of the same or of distinct species. The pods which developed from these flowers were harvested separately, and in the following season the seed was sown to determine, as far as possible, the degree of natural interspecific pollination which had occurred. The following results were obtained :—

(*a*) From swede open-pollinated in the presence of rape and turnip, sixty-three plants attained full development ; of these, twenty-five were recognized as Swede × Rape, the balance resembling pure swedes.

(*b*) From turnip open-pollinated in the presence of swede and rape, twenty-five plants attained full development. Of these, seventeen resembled the Turnip × Swede, and eight the Turnip × Rape hybrids. Only one turnip plant had in the previous season reached the flowering-stage. As this one plant failed, unaccountably, to produce seed on self-pollination, it follows that all seed formed must necessarily have arisen as a result of pollination by other species.

(*c*) From rape open-pollinated in the presence of swede and turnip, fifty-five plants attained full development ; all resembled normal rape.

Although no definite explanation can be offered for the non-appearance of turnip hybrids in (*a*) or for the apparent absence of any hybrid plants in (*c*), it is evident that when rape, turnips, and swedes are grown in close association a certain amount of natural cross-pollination can occur. No evidence was obtained as to what the extent would be, consequent upon wider spacing. English seed firms advise at least a quarter of a mile between distinct species or varieties.

Hybrid Forms.

Crops grown from commercial seed of rape, swede, and turnip are, as a rule, remarkably free from types indicative of contamination by "foreign" pollen. Nevertheless, such off-types are occasionally observed, and a knowledge of the appearance of hybrid forms of known parentage should be helpful to the seed-grower in enabling him to identify such plants.

Before describing the various hybrid forms, mention should be made of the manner in which certain characters are transmitted ; such information may prove to be of some use in determining the probable source of "foreign" pollen and in indicating the precautions that must be made in future years.

Rapes, swedes, and turnips each possess certain characteristics which serve to distinguish them.

Table II.—Some Distinguishing Characteristics of Rape, Swede, and Turnip.

Species.	Skin-colour.	Flesh-colour.	Flower-colour.
Rape—			
Giant ..	White	White ..	Bright lemon-yellow.
B.L.E. ..	White	White ..	Paler yellow than giant.
Swede ..	Purple	(1) White	Bright lemon-yellow.
	Bronze		
	Green	(2) Yellow	Dull buff-yellow.
Turnip ..	White	(1) White	Bright lemon-yellow.
	Green		
	Red	(2) Yellow	Dull buff-yellow ; paler than swede.
	Purple (green + red) ..		

When two individuals possessing contrasting characters are crossed the immediate or first progeny will generally exhibit only one of these characters; that observed in the first generation is referred to as the dominant character.

The observations made at this Station confirm those made by Davey(4), and may be summarized as follows:—

(1) White flesh is dominant over yellow flesh.

(2) A bright lemon-yellow flower-colour is associated with white flesh, and a dull yellow-buff colour with yellow flesh. In a flowering crop, therefore, it is sometimes possible to locate certain rogues by flower-colour; bright lemon-yellow flowers indicate roots with white flesh, and yellow-buff flowers roots with yellow flesh.

FIG. 1. LINCOLNSHIRE RED TURNIP × GRAND MASTER SWEDE. SHOWS FORMATION OF HYBRID NODULES—NOT CLUB-ROOT.

(3) Green skin-colour and red skin-colour are independent of one another, but when associated together in the one plant produce a purple effect. By scraping away the red of purple roots the green may be observed beneath. Both green and red are dominant over white skin.

(4) An additional point of interest is that the roots of hybrids obtained by crossing turnips and swedes are characterized by irregular knoblike swellings similar in appearance to those caused by the disease known as "club-root." They are termed hybrid nodules (Fig. 1).

The practical significance of these facts will be appreciated by an observer when endeavouring to determine the probable source of pollen-contamination.

Appearance of Hybrid Forms.

(Note.—In each cross the mother plant is mentioned first.)

1. (*a*) *B.L.E. Rape* × *Yellow-flesh Swede.*

Foliage.—Abundant, rape-like in appearance, dense, and erect; short central stalk with numerous side branches. Leaves: Similar to those of rape. Colour: Greyish-blue, green.

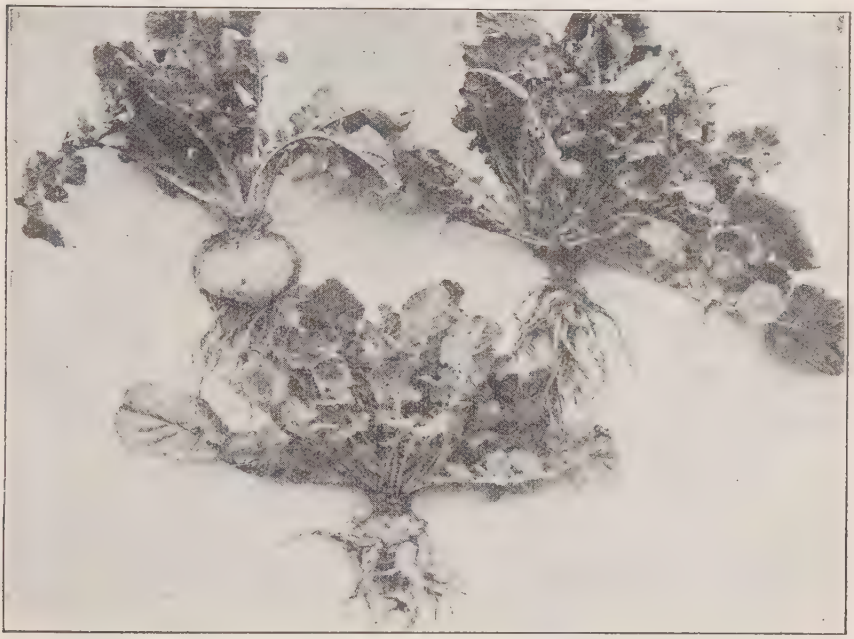

FIG. 2. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, SWEDE × RAPE.

Bulbs.—Slightly developed, misshapen, and very fangy. Flesh: White or greyish in colour and rather woody. No colour in exposed surface. A pronounced neck is evident, the scars of which are slightly tinged with purple, as are the bases of the side stalk. No marked development of nodules.

Flower-colour.—Yellow.

1. (*b*) *Yellow-flesh Swede* × *B.L.E. Rape* (Figs. 2 and 7).

Foliage.—Varies between that of rape and swede; greyish-blue-green in colour with the stalks in some cases tinged with purple. Shape and appearance of leaf also varies between that of rape and swede.

Bulbs.—Small to medium sized, generally uniform in shape, but extremely fangy. Flesh: White in colour and woody. No colour in

exposed surface. A pronounced neck, the upper scars of which are coloured purple, as are also the bases of the side stalks. No appearance of nodules.

Flower-colour.—Yellow.

2. (*a*) *Yellow-flesh Swede* × *White-flesh Turnip* (Figs. 3 and 7).

Foliage.—Intermediate in appearance between that of both parents, the colour of some plants tending more towards the bright-green colour of turnips, while that of others is the greyish tinge of swedes. Shape of leaf and habit of growth are more like those of swede than of turnip.

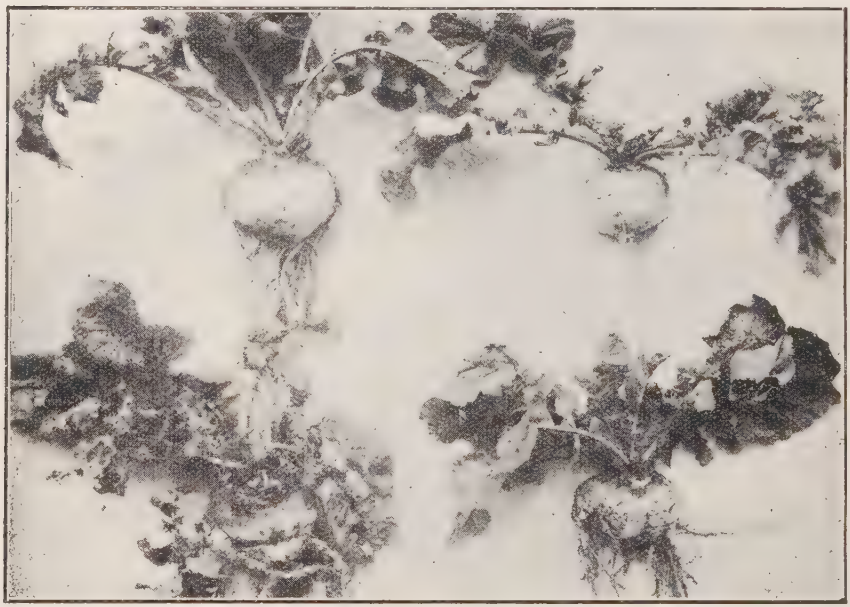

FIG. 3. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, LINCOLNSHIRE RED TURNIP; BOTTOM LEFT, TURNIP × SWEDE; BOTTOM RIGHT, SWEDE × TURNIP.

Bulbs.—Medium size, misshapen, fangy, slight neck-development. Flesh: White in colour and firm in consistency. Exposed surface: Generally without colour. Neck scars: Usually purple. Small bulbous nodules similar to those of club-root, but identified as not being such, are present on the roots; are termed hybrid nodules.

2. (*b*) *White-flesh Turnip* × *Yellow-flesh Swede* (Fig. 3).

Foliage.—Rather abundant, tending more towards the appearance of turnip than of swede; bright-green in colour, with shape and habit similar to those of turnip.

Bulbs.—Medium to large, misshapen, fangy, with slight neck-development. Flesh: White in colour and of a firm consistency. Exposed surface: Purple in colour with an uneven green band round lower margin. Neck scars: Purple; this colour is continued as a tinge into the stalks. Marked nodule development (Fig. 1).

Flower-colour.—Yellow.

3. *White-flesh Turnip* × *B.L.E. Rape* (Figs. 4 and 7).

Foliage.—Short, dense, bright-green in colour, similar to rape in habit, but with colour of turnip. Leaves: Medium length, rather narrow, with fair lobe-development; no colour in stalk.

Bulbs.—Practically no development; only a small woody swelling; very fangy. Flesh: White in colour. No colour in exposed surface. A short stout neck, from which numerous side stalks arise. No nodule development.

Flower-colour.—Yellow.

FIG. 4. TOP LEFT, LINCOLNSHIRE RED TURNIP; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, TURNIP × RAPE.

4. *Yellow-flesh Swede* × *Wild Turnip (white flesh)*, (Figs. 5 and 7).

Foliage.—Scanty but vigorous, intermediate in appearance between swede and wild turnip, but tending more towards the wild turnip. Leaves: Rather large, semi-erect, and much lobed. Stalks: Purplish-red in colour.

Bulbs.—Medium to large in size, generally a little flattened, being wide from side to side in one direction; set rather deeply in the ground; very fangy. Flesh: White in colour, with a firm consistency. Exposed surface: Reddish-purple in colour, with a slight green band. Neck-development variable, scars purple, which colour is continued on into stalk. Distinct nodule development.

Flower-colour.—Yellow.

5. *White-flesh Turnip × Wild Turnip (white flesh)*, (Figs. 6 and 7).

Foliage.—Prostrate and bright-green in colour. Leaves of a medium size and much lobed; stalk purplish. A few plants developed seed-stalks.

Bulbs.—Development poor; small to medium size, misshapen and fangy. Flesh: White in colour, with a firm fleshy to woody consistency. No colour in exposed surface. Practically no neck. Scars of crown tinged with purple, which colour is continued into stalks. Distinct nodule development.

Flower-colour.—Yellow.

FIG. 5. TOP LEFT, GRAND MASTER SWEDE; RIGHT, WILD TURNIP; BOTTOM LEFT, TWO ROOTS OF SWEDE × WILD TURNIP.

Application of the Results.

It is evident that cross-pollination with subsequent fertilization can be effected quite readily between rape, turnips, and swedes. The results, however, afford no definite indication as to the actual contamination which may occur in the field when two or more distinct forms are grown within short distances of one another. Under these conditions certain limitations may influence the issue:—

(1) The forms may flower at different times. If there is no overlapping of the flowering periods no cross-pollination can occur.

(2) Generally speaking, the pollen from plants of a certain form is more effective on individuals within that form than on those of a different form.

(3) When an area consists of numerous plants of one form all growing in close association the superabundance of the "home" pollen should restrict the effect of "foreign" pollen.

(4) The prevailing wind may predispose the flight of insects carrying pollen to a particular direction.

FIG. 6. TOP LEFT, LINCOLNSHIRE RED TURNIP. OTHER SPECIMENS REPRESENT A RANGE OF TYPES OBTAINED FROM TURNIP × WILD TURNIP; THE WILD TURNIP PARENT HAS NOT BEEN INCLUDED.

Despite these limitations and in view of the fact that hybridization can and does occur, distinct forms and varieties when grown in the same vicinity should always be strictly isolated one from the other. If such a precaution is taken, and provided any casual wild turnips are eradicated, a grower can be more definitely assured of producing a seed crop, the progeny of which should exhibit a satisfactory degree of purity.

CONCLUSION.

Interspecific cross-pollination, with subsequent fertilization, can be effected artificially, and also takes place naturally between rape, swedes,

turnips, and wild turnips. The progeny of these inter-relationships is generally inferior to the parental forms, and consequently in the production of these seeds every effort should be made to prevent the incidence of foreign pollen. No seed was obtained when chou moellier was crossed with any of the above forms.

FIG. 7. TOP LEFT, SWEDE × RAPE; TOP RIGHT, TURNIP × RAPE; MIDDLE LEFT, SWEDE × WILD TURNIP; MIDDLE RIGHT, TURNIP × WILD TURNIP; BOTTOM, SWEDE × TURNIP.

Acknowledgment.

This work was suggested by, and carried out under the direction of, Mr. J. W. Hadfield, Director, Agronomy Division, Lincoln.

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FRUIT-CROP PROSPECTS.

THE Director of the Horticulture Division has received the following reports from his officers regarding the fruit-crop prospects at the end of October, 1937:—

Auckland.—Apples: Heavy blossoming and a good setting. Gravensteins light. Lemons: Blossoming freely. Nectarines: Poor setting. Oranges: Poorman blossoming freely. Peaches: Light setting. Pears: Heavy setting most varieties. Plums: Generally light. Strawberries: Medium crop. Rain needed. Tomatoes: Hothouse good crops. Heavy plantings of outdoor varieties.

—*L. Paynter.*

Tauranga.—Apples: Dunn's and Dougherty patchy. Promise of good average crop other varieties. Apricots: Light to very light. Gooseberries and pears: Good. Lemons: Promise of good main blossoming. Oranges: Good blossoming. Nectarines and peaches: Light. Plums: Average to good. Tomatoes: Average plantings; both outdoor and under glass definitely backward.

—*A. R. Grainger.*

Hamilton.—Apples: Satisfactory blossoming on most varieties. Gooseberries: Heavy. Lemons: Promise of good blossoming for main crop. Peaches: Heavy blossoming all varieties. Pears: Heavy blossom. Plums: Excellent blossoming. Plums (Japanese): Heavy blossoming and setting. Strawberries: Prospects of average crops. Grapes: Outdoor—Vines moving away well.

—*R. G. Hamilton.*

Gisborne.—Apples: Indications crop will be generally heavy. Apricots, nectarines, and peaches: Average to heavy. Gooseberries, plums, and walnuts: Average. Lemons: Main winter crop now harvested. Oranges: Indications are for heavy blossoming. Pears: Heavy. Strawberries: Light. Tomatoes: Plants backward due to cold temperatures.

—*P. Everett.*

Hastings.—Apples and pears: Heavy crops all varieties. Apricots, cherries, gooseberries, raspberries, strawberries, and walnuts: Average. Lemons and oranges: Moderate bloom. Nectarines: Reduced heavily in some areas through frost. Peaches: Some varieties reduced by frost in parts, but heavy district yield expected. Plums: Heavy. Plums (Japanese): Some varieties reduced by frost in parts, but good district yield expected. Tomatoes: Heavy plantings.

—*N. J. Adamson.*

Palmerston North.—Apples and pears: Indications point to heavy setting. Apricots: Very light setting owing to late frosts. Cherries and nectarines: Very light setting. Gooseberries: Good average crop. Peaches and plums: Patchy to light setting. Raspberries: Good promise; not many grown. Strawberries: Well forward; promise well. Tomatoes: Outside plants backward; many killed by frost.

—*J. W. Whelan.*

Masterton.—Apples: Abundant blossoming most varieties. Apricots: Very light crops expected owing frost injury. Cherries: Good blossoming; light crop. Gooseberries: Good to heavy. Nectarines, peaches, and plums: Very light. Pears: Fair crops. Raspberries: Canes looking very well; well furnished for time of season. Strawberries: Abundant bloom; fruit setting well. Tomatoes: Looking well under glass. Outdoor planting not commenced.

—*M. Davey.*

Nelson.—Apples: Very heavy blossoming of nearly all varieties. Apricots: Moderate crop. Cherries and raspberries: Good crops anticipated. Gooseberries: Good crop. Lemons: Moderate crop anticipated. Nectarines: Good crops where no frost damage was suffered. Peaches: Moderate to good crop expected. Pears: Winter Coles patchy in places. All other varieties showed very heavy blossoming.

Indication of moderate to good crop. Plums: Moderate to good crops showing. Strawberries: Good crops anticipated. Rain badly needed. Tomatoes: Indication of good crops in glasshouses. Outdoor planting almost completed.

—*R. E. Binfield.*

Mapua.—Apples: Heavy blossoming of practically all varieties. Cox's Orange and Jonathan varieties exceptionally heavy. Sturmers patchy. Delicious in places do not appear to be setting well. Weather conditions not favourable to development. Pears: Good blossoming of all varieties. Winter Coles appear to be setting light; other varieties fair to good.

—*A. T. Douglas.*

Motueka.—Apples: All varieties blossomed heavily. Good set of fruit. Apricots: Fair set. Cherries: Heavy blossoming. Gooseberries: Up to average. Nectarines: Good average crop set. Peaches: Showing well; signs of good crop. Pears: Good setting of fruit all varieties. Plums: Fairly good, especially where not damaged by frost. Raspberries: Canes coming into good growth. Strawberries: Good crops showing at present. Tomatoes: Outside plantings almost finished.

—*G. Stratford.*

Blenheim.—Apples: Present indications are for a heavy crop of all varieties, except Cox's and Dunn's, which are light. Apricots: Average to heavy. Cherries, peaches, and raspberries: Indications are for average to heavy crops. Gooseberries and strawberries: Crops generally heavy. Nectarines: Average to heavy crop set. Pears: Crop most varieties light. Plums: Crops generally average to light. Plums (Japanese): Average to light crops showing. Tomatoes: Average to heavy crop of hothouse. Outdoor damaged by frost, and a certain amount of replanting will require to be done. Walnuts: Crops light due to frost injury.

—*D. J. Hogg.*

Christchurch.—Apples: At present prospects of heavy crops of all varieties. Apricots: Medium to light. Cherries: Prospect average crop. Gooseberries: Medium to heavy. Nectarines: Medium crops except where damaged by frost. Peaches: Average crops except where damaged by frost. Pears: Prospects of heavy crops of all varieties. Plums: Medium to heavy except where damaged by frost. Plums (Japanese): Heavy crop. Raspberries and strawberries: Prospects of medium to heavy crops. Tomatoes: Under glass, average crops. Walnuts: Medium crop where not damaged by frost.

—*B. G. Goodwin.*

Dunedin.—Apples: Heavy blossoming all varieties other than Jonathan affected by frost. Apricots: Slightly below average due to frost. Cherries and gooseberries: Average. Nectarines, pears, and plums: Below average. Pears: Severely reduced by frost. Strawberries: Reduced by frost. Walnuts: Affected by frost.

—*G. H. McIndoe.*

Alexandra.—Apples: Very heavy blossoming all varieties. Apricots: Average set. Cherries, nectarines, peaches, and pears: Very heavy set. Plums: Very heavy blossoming; drop now occurring which may reduce crop very considerably. Strawberries: First flowers frosted; later crop heavy. Tomatoes: Now commencing to plant out. Walnuts: Heavy set, but some frosted.

—*W. R. L. Williams.*

SEASONAL NOTES.

THE FARM.

Importance of controlling Pasture-growth in Summer.

THE importance in respect to the nutrition of stock of preventing, as far as practicable, the development of stemminess in pastures was discussed in these notes last month. To sum up the position, "wet" stock—*i.e.*, cows, sows, and breeding-ewes—are capable of heaviest production, which normally is most economical production in respect to feed-consumption; young stock growing at the quickest rate of which they are capable normally are next in order of heavy production. The heavier the production the greater is the need for leafy pasture growth, with its greater digestibility; its greater content of mineral matter, which is required for the formation of milk and bone; and its greater content of protein, which is required for the formation of milk and flesh. The rations of wet and growing stock are in summer often below full requirements in respect to digestibility, mineral content, and protein content.

Apart from the quality of the feed, an additional advantage of maintaining pastures in a leafy condition is that to do so prolongs the period of their growth. The more pastures are allowed to become stemmy in summer the more do they appear to exhaust themselves in the development of flower-heads, and certainly they assume a condition of low production of leafage during a considerable and critical part of the season of farm-stock production—that is, during late summer and early autumn. On the other hand, pastures in which flower-head development has been minimized have a correspondingly greater tendency to continue the production of leafy herbage right through the season.

Still another advantage of avoiding stemmy growth in pastures as much as possible is the fact that swards which are allowed to become tall tend to become undesirably open and certain valuable species may be weakened by taller-growing competitive species in the sward.

Important means of maintaining leafiness in pastures during summer were set down in these notes last month. Further to last month's notes, for the purpose of stimulating fresh leafy growth in the latter part of the summer, at times it may be advantageous to top-dress some of the pastures of a farm with superphosphate in early summer. Observation in the field points to the conclusion that such top-dressing is most effective in districts in which a good deal of rain falls in December and January. As such rainfall decreases, top-dressing declines in effectiveness as a means of obtaining additional late summer leafy feed until a point is reached when its influence upon the summer leafiness of pastures is negligible. Areas from which hay or silage has been saved often profitably may be top-dressed in December with superphosphate, which tends to increase the production of leafy feed later in the summer, when such feed frequently is in scant supply and therefore particularly valuable. It has been found that later on the influence of phosphates applied about mid-summer approximates that of identical fertilizer applied in the autumn.

The facts about the summer control of the growth of pastures given herein and in the last month's notes have long been known; the economic value of their application has been demonstrated strikingly by certain progressive grass-farmers. But, despite the fact that their pastures could be kept in a much more leafy condition during summer

without any great outlay or effort, a great many farmers do nothing year after year to improve their inefficient summer control of the growth of their pastures.

Lucerne Culture.

As a rule, in many districts best results are obtained by sowing lucerne in the latter part of November or in December. Sometimes in favourable seasons or other favourable conditions, such as location, good results are obtained by earlier sowing. The basic fact that should be reflected in practice is that the ultimate success obtained with lucerne depends to a considerable extent upon the rapidity of its growth in its infancy, which in its turn, when supplies of moisture and plant-food are adequate, is determined by the warmth of the soil. Hence, as a rule, there is no justification for taking the risk of slow initial growth due to early sowing, unless it is expected that dry conditions will be experienced in late summer before a crop sown late in November or in December has become safely established. Special circumstances may justify late summer or autumn sowing, which sometimes is quite successful; but in the milder districts in which certain of the plants which commonly invade lucerne make some growth, even if but little, practically through the winter, late summer or autumn sowing of lucerne usually is unsuccessful, except when much tedious weeding is carried out to prevent the smothering by the invading plants of the lucerne seedlings at a standstill in their growth during the winter.

A fine, firm seed bed contributes to rapid, vigorous establishment of seedlings and is essential for best results. Good results follow sowing 12 lb. to 18 lb. an acre of seed through every coulter of a grain-drill; the poorer the preparation of the seed-bed, the more seed is required. Broadcasting of the seed and covering it by light harrowing is an alternative practice which as a rule gives results not quite as good as drilling. Generally, lime may be applied profitably before the final cultivation preceding seed-sowing, and the application of phosphates at or about the time of seed-sowing is, as a rule, distinctly beneficial to net returns. Inoculation, the importance of which is noted subsequently herein, may not take place if superphosphate comes in contact with the seed and nullifies inoculating treatment—this undesirable effect may, however, be avoided by not sowing seed and superphosphate mixed together. When it is desired to sow seed and fertilizer mixed together this may be done safely by using an insoluble fertilizer such as basic slag or by sowing the seed with carbonate of lime and superphosphate mixed in equal proportions for about a week before bringing the seed in contact with the mixture.

Lucerne, in common with other legumes such as peas and clovers, works in partnership with certain soil bacteria. The legume helps the bacteria by furnishing them with a home and food, but the bacteria are so helpful to the legume by supplying it with nitrogen, which they get from the air, that they are essential for full thrifty development of the legume. Different legumes work in partnership with different strains of bacteria, and there is no way which can be used by farmers before growing the crop of discovering whether the soil contains sufficient numbers of the organism suitable for a specific crop. Although the organism needed for full success with lucerne is present in some soils in adequate supply, in other soils it is not so, and hence the safest course is to supply the organism artificially. This is called soil inoculation. Field experience shows that in various districts throughout New Zealand poor past results with lucerne have been due primarily to the absence of the particular organisms with which lucerne works in partnership. Supplies of the bacteria are called cultures and may be bought from the Department of Agriculture at a cost of approximately 1s. for the treatment of the seed sufficient for an acre.

Often lucerne should be mown in November or December. If the weather is unfavourable to the production of good hay the lucerne may be used for ensilage. Should the amount of lucerne available be too small to allow of ensilage without undue waste, then it may be saved, together with green material from the pastures or from such a crop as green oats. The making of good lucerne hay calls for care designed to avoid the loss of leaves, which readily occurs if handling is faulty. The mown material should not be left in the swathe to dry sufficiently to allow of direct carting to the haystack—this would result in the leaves, which are much more nutritious than the stalks, becoming dry and brittle and in many of them being lost during carting in. To avoid such serious loss lucerne hay should be cocked. Lucerne hay fairly often is stacked before it is dry enough—this is probably so because the stems do not become dry enough as quickly as do the leaves.

Lucerne should be mown when new shoots are just starting from the crowns or bases of a considerable number of the plants. As a rule, when new shoots have so developed about a quarter of the plants are in the early-flowering stage, but as this is not always true, reliable guidance about the time to mow is not provided by observation of the flower-development.

General Cropping.

Good farmers in most districts become very busy with special cropping work in November and December.

Of the crops generally sown at this season the swede is of outstanding importance. Partly as a means of reducing the ravages of diseases such as club-root and dry-rot, swedes are almost always sown on land ploughed out of grass, and records relative to farmers' field competitions definitely point to the advantages of this practice. Over wide areas successful results may be expected from sowing swedes in December at the rate of 10 oz. to 14 oz. an acre. Sowing through every second coulter of an ordinary grain-drill is probably most popular, but sowing through every coulter has often given good results, and, especially in the South Island, sowing in ridges followed by intertillage also consistently has given good results. The popularity of varieties of swedes differs greatly from one district to another; in the southern portion of the North Island Superlative, Majestic, and Grandmaster have proved popular, while in Southland, Elephant and Masterpiece seem to have been favoured considerably. It now is common practice in districts of good rainfall to use 2 cwt. to 3 cwt. an acre of fertilizer of which phosphate is the dominant constituent, while in districts of such low rainfall, as is normal in Canterbury, superphosphate at the rate of about 1 cwt. an acre mixed with an equal amount of carbonate of lime is favoured.

The sowing of soft turnips also is often carried out successfully during December, 12 oz. to 14 oz. an acre of seed in rows 7 in. apart being used frequently as also is a seeding of 8 oz. to 14 oz. an acre in rows 14 in. apart, while in the case of crops to be thinned about 9 oz. to 14 oz. of seed are sown in drills 26 in. apart, and when soft turnips are broadcasted about 2 lb. of seed an acre are used.

Rightly chou moellier maintains its popularity, which in some districts seems to be increasing, this possibly because of its reliability and its relatively low labour requirement. It is highly desirable to bear in mind that success with chou moellier calls for high fertility such as is required for success with cabbages. If suitable fertility is not present naturally it may be provided by the use of farm manure, such as old stack bottoms and animal excreta, together with artificial fertilizer

in which superphosphate may well be prominent. Sowings in December provide winter feeding. A suitable sowing is 1½ lb. to 2 lb. an acre broadcast or ½ lb. to ¾ lb. an acre in drills 2 ft. to 2½ ft. apart.

Much of the considerable area devoted to rape in New Zealand is sown in Canterbury or in districts with climatic conditions which approximate those of Canterbury. The fullest success with rape calls for a well-prepared, firm, fertile, moist seed-bed. As a rule ten weeks to twelve weeks on light land and twelve weeks to fourteen weeks on heavy land elapse between the date of sowing and the date the crop reaches the best stage for use in the fattening of lambs—called the "ripening" stage. Sowing usually is carried out from late in October on light land to January on heavy land, on which sowing prior to early November is not usual because rape responds well to warmth at the outset. Rape usually is sown at the rate of 2 lb. to 3 lb. an acre, being drilled in rows 7 in. or 14 in. apart. On heavy land the 14 in. rows are usually preferred, as the wider rows minimize the wastage that sometimes occurs in dense crops. Good results may be expected from the use of 2 cwt. to 3 cwt. an acre of a mixture in equal parts of superphosphate and lime drilled in with the seed, while reverted superphosphate at the rate of 2 cwt. to 3 cwt. an acre is also a suitable fertilizer for rape. While the area of rape required to fatten a given number of lambs varies greatly mainly because of substantial variations in the yields of different crops and in the drafts of lambs to be fattened, the following generalizations are in accord with field experience: A good crop of rape fattens twenty-five to thirty lambs an acre, an average crop fifteen to twenty-five lambs, and a somewhat poor crop eight to fifteen lambs an acre.

In the sowing of swedes, turnip, rape, and chou moellier special care should be taken to avoid the serious injury to the seeds which results by bringing them in contact even for a short time with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. One way of avoiding the injury caused by superphosphate is to mix one part, by weight, of suitable ground limestone (carbonate of lime) with one or two parts of superphosphate. The mixture should not be bagged as soon as it is made as it usually sets hard to some extent; it may be bagged after it has been made two or three days, when it may be pulverized easily in the heap. Unfortunately, some lines of ground limestone are not effective for the purpose just mentioned, and a farmer uncertain about the efficiency of any particular limestone for this purpose may obtain guidance from the local officer of the Fields Division.

In some districts the use of borax for the control of brown heart in swedes is advisable, but in other districts it is considered unnecessary, and evidence points to the indiscriminate use of borax being at times wasteful.

There seems to be some confusion as to the purpose of using borax in growing swedes, it being thought in some instances that the use of borax would assist in the control of such diseases as dry-rot and club-root. Actually the use of borax is recommended solely for the control of the specific disorder brown-heart, and where brown-heart has not been in evidence the use of borax is not known to give any benefit. Borax, if not used in a suitable manner, is known readily to lower the germination of swede-seeds to a serious extent. Full particulars about the safe and profitable use of borax under varying conditions may be obtained from the Department of Agriculture.

Spraying for the control of late blight of potatoes (*Phytophthora infestans*) may be advisable. For this purpose Bordeaux mixture has proved effective provided a thorough covering is maintained. This may necessitate frequent spraying, but in dry seasons or in dry districts it has been found that spraying is not necessary. Generally spraying may

be expected to give good results only when it serves as a preventive instead of as a cure. While spraying may be of considerable value in checking the spread of blight which has gained a footing, its greatest service results from preventing the footing being obtained. If suitable procedure is not followed in either preparing or applying the spray the result is likely to be either damage to the crop or failure to control the blight. Detailed guidance about spraying may be obtained from local officers of the Fields Division.

Maize and millet to provide green feed usually may be sown with success in November or December. Good results have been obtained by sowing maize broadcast at the rate of 75 lb. an acre (12 lb. to 15 lb. an acre in rows 3 ft. apart are sown for cob maize) and covering the seed by a very shallow ploughing. Sowing Japanese millet at the rate of 15 lb. to 20 lb. of seed an acre has consistently given good results. Usually both of these crops profitably may receive 1 cwt. to 2 cwt. an acre of superphosphate, and unless the soil is distinctly fertile it usually is profitable to include also some nitrogenous matter in the manurial dressing.

In its advisory work the United States Department of Agriculture emphasizes that "good seed is cheap at any cost, poor seed is time and money lost," a pithy statement of facts which well might be given more attention by New Zealand farmers than it seems to receive. According to the Seed Analyst, the work of the New Zealand Seed-testing Station shows that the standard of the seed trade in New Zealand is, on the whole, a high one. While this is a matter for congratulation, against it is to be set the fact that very poor lines of seed are at times sold to farmers who do not take the precautions needed to ensure a supply of truly satisfactory seed; in fact, these poor lines of seed are at times so poor that it is quite impossible to get any but grossly disappointing and unprofitable results from their use. Assuming that the appropriate strain or variety of seeds is being purchased, the real value of the seeds depends basically upon (1) the extent to which they are true to name, (2) the percentage of the true-to-name seeds which are capable of germination, and (3) the vigour of their germination. The farmer must depend to some extent upon the integrity of the seed trade in respect to the seeds being true to name, but he has some important protection in that official information is obtainable as to the impurities and inert matter in seeds, and impurities may include most undesirable weeds. The farmer is able to obtain from official sources all necessary accurate information about the germination of seeds. A point to which it seems necessary yet to direct attention, although it often has been emphasized in the past, is that neither the appearance nor the bushel-weight of seeds is a reliable index of their real value and, indeed, in purchasing seed one may go far astray by using either appearance or bushel-weight, or both of these, as a measure of value.

Intertillage and Thinning.

Insufficient tillage is one of the most common causes of crops being limited in yield. The value of the cultivation which gives a good seed-bed is generally known even though at times, judging from farm practice, this knowledge seems to be overlooked. But the value of suitable cultivation after the sowing of the seed, when such cultivation is practicable, is not so generally realized; and this type of cultivation is of special importance at this season. Apart altogether from weed-control, which is of basic importance, a growing crop in badly cultivated ground is not likely to obtain the fullest possible benefit from money spent on good seeds and the liberal use of suitable fertilizers. Further, if a dry spell of weather occurs such a crop is likely to suffer in

yield because of the inadequate supply of moisture in the soil—suitable surface cultivation assists in conserving soil-moisture. Hence, intertillage of growing crops sown in rows wide enough apart to allow of it is in general highly desirable even though weeds are not a menace to the crop. This is particularly true of the drier districts.

Often in December thinning, as well as intertillage, of crops sown in October or November is advisable. The task of thinning usually may be lessened by prior hoeing along the rows. Thinning is most valuable if done as soon as the seedlings are large enough to allow of easy handling. The weeding which is carried out during such early thinning brings about the destruction of the weed-seedlings at the stage when they are most easily destroyed. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them.

—R. P. Connell, Land Utilization Officer.

THE ORCHARD.

Pest and Disease-control.

Reference to the spray programme issued in the September number of the *Journal* will act as a guide to growers with their spraying operations during the next month or so. In the spray schedule given on page 179 of the September *Journal*, under (3) "Petal-fall period," a transcription error has occurred—the lime-sulphur dilution should read 1–150, not 1–500 as printed.

Fruit-trees are now in full leaf, and therefore it will be more difficult to obtain a complete coverage with the spray. A little extra time spent on each tree to ensure that every branch, twig, and leaf has been coated with spray will be time well spent. Good pressure is very necessary, especially if the trees are at all dense. The system of pruning with the reduced number of leaders that is now being practised in many orchards materially assists spraying operations, as it enables all parts of the tree to be reached with comparative ease. From now on warm, dry weather conditions may be expected, and some growers are apt to take undue advantage of such conditions by lengthening the period between sprays, insecticidal or fungicidal, beyond the time for which they are effective. It must be remembered that to get the best results from spraying a protective covering should be on fruit and foliage all the time; consequently to extend the period between sprays over the recommended fourteen to eighteen days is running an undue risk. Insect pests are on the increase at this period of the year, and precautions taken now will prevent them from establishing themselves to the detriment of fruit and foliage later in the season. Many growers are inclined to leave the first application of lead arsenate for the control of codling-moth until the fruit is well advanced. It should be remembered that the "calyx" spray is of importance in the control of this pest, and neglect in this respect cannot be remedied. This early spray of lead arsenate will also control bronze beetle. As previously recommended, lime-sulphur solution may now be reduced in strength to 0·083 per cent. (1–180), especially where colloidal sulphur at a dilution of 2 lb. per 100 gallons of spray is used in combination. Where the lime-sulphur and lead arsenate are used in combination it is advisable to add to the mixture 2 lb. of hydrated lime to prevent russet and scorch. Regular sprayings with lime-sulphur at this time of the year should keep red-mite in check until January, when it may be necessary to apply summer oil at strength 1–100 for its control.

Thinning.

Reports from all parts of the Dominion indicate that, with the majority of varieties of apples, the setting of fruit has been good; and, although a customary natural dropping may be looked forward to, it appears as though the crops are going to be particularly heavy. Growers are therefore advised to spend more time on thinning fruit than has been the usual custom. There is no doubt that this practice is not given the attention it should receive, with the result that many growers harvest a large crop of small fruit. It should be remembered that whilst it costs more to prepare a crop of small fruit for market, the price obtained for such fruit is almost always below the average. Very seldom does a grower over-thin his fruit crop—usually it is the reverse. It is not the quantity of fruit that is taken off the tree when thinning that counts, but the balance left on the tree after adequate thinning has taken place. The ground round the tree may be carpeted with small fruit, and still the tree have too much left on to give the best results. Not only will the proper thinning of fruit produce improved quality on the remainder, but at future sprayings more efficient coverage of the fruit to protect it from codling-moth and leaf-roller caterpillar will be obtained. The resultant crop will also be more uniform in size, whilst the grade will be raised considerably. The elimination of diseased, malformed, and clustering fruit will reduce the percentage of waste to be handled at harvesting time, and also help to promote more growth and bud development on the tree for the production of fruit.

At least two thinnings should be given to the majority of varieties, and in some cases it is of advantage to give three, usually commencing soon after the natural drop for each variety has taken place. During the first operation all clusters should be reduced to two or three fruits at the most, always taking out the centre fruit. Care should be taken not to injure the remaining fruits or spur. The operation can readily be done by pressure of the fruit to be taken off between the thumb and finger, with little or no damage to the spur. If this method is not favoured, thinning-shears can be used, but care must be taken not to pierce the remaining fruits with the points of the shears. At the second thinning all diseased or malformed fruits should be eliminated, and any further spacing necessary should be attended to. The object should be to see that every individual fruit has sufficient room to develop and mature naturally. If this is done fruit of good colour, shape, and size will be the result.

Grafts.

Grafting for the season will have passed long before these notes appear, and the scions should now be starting well into growth. It is well to examine these grafts periodically and see that no strangulation is taking place by the bindings (where used). Where such is the case, the binding should be cut on the opposite side of the stock from the graft to allow for the free growth of the scion, which is usually heavy at this time of the year. All growths coming from the stock should be rubbed off, except in cases where the renovation of trees by the "porcupine" system of grafting has been done. It is sometimes necessary to leave a growth here and there, where a graft has not taken, to provide good wood for budding-purposes later in the season; otherwise all shoots should be suppressed.

General.

Growers are advised to keep a sharp look-out for signs of fireblight. Blossom-infection not detected will spread to the twigs and laterals, when the foliage on affected portions will droop, turn brown, and hang on the tree. All such infections should be cut out and destroyed as soon as possible.

Cultivation should be continued throughout the month by frequent stirrings of the soil by harrow or cultivator, especially after rain. This will not only reduce the soil to that fine tilth so necessary, but will help to conserve moisture for the drier periods later in the season.

As harvesting time is approaching, casemaking should be undertaken at every opportunity. Packing-sheds and grading-machines, &c., should also receive attention. Usually during the off-season the packing-shed is the housing-place for almost every spare part on the farm, whilst in some cases rotting fruit is allowed to remain until the following season. Reports on the fungal rotting of fruit on the overseas markets point to unhygienic conditions prevailing in and around the packing-shed; therefore it is imperative that every grower should take the necessary precautions to see that the packing-shed and its surroundings are kept clean and in an hygienic condition to avoid further losses in the future. This can only be done by a thorough cleaning of the packing-shed, grading-machine, lidding-press, benches, &c., getting rid of any old disease-ridden fruit-cases, and by thoroughly spraying the whole with a solution of bluestone (1 lb. per 400 gallons water), (metals should be protected from this solution), or with formalin solution (1 part by volume of commercial formalin to 50 parts water).

—George Stratford, Orchard Instructor, Motueka.

Citrus Culture.

Most citrus trees will be in bloom when these notes appear, this being the commencement of the next main crop, is also the commencement of the period wherein the trees require expert cultural attention. Neglect to cultivate at any period during the development of the fruit may result in considerable loss.

Disease-control.—As mentioned in these notes for the previous month, this is the most important period of the year for the control of verrucosis, and where there is danger of infection the trees should receive their first preventive spray when the earliest fruits of the main crop are setting. Bordeaux mixture at a strength of 3–4–50 is recommended for this purpose.

Bark-blotch is a disease that kills the bark and is usually found attacking mature trees either on the trunk or in the main forks of the tree. The presence of the disease is indicated by a slight discoloration of the affected area, and not infrequently is associated with an exudation of gum. The disease is particularly active at this period of the year, consequently all trees should now be examined carefully for signs of infection. Control-measures consist of cutting out all of the dead bark—cutting well back into the healthy bark—and swabbing the wound with bordeaux paste. When dry the area should be painted with a wound-dressing of the bitumen-emulsion type. Before commencing to operate on a diseased tree a ground-sheet should be spread around the tree to catch all of the diseased tissue removed. This infected material should be burned and not left in the orchard to become a source of further infection.

Insect Pests.—The examination of trees for the presence of wood-borers can be made at the same time as the trees are inspected for bark-blotch. The treatment for this pest appeared in these notes for December last.

Scale insects are probably the most persistent of the insect pests attacking citrus. The two species most prevalent are the black scale (*Saissetia oleae*) and the red scale (*Chrysomphalus aurantii*). Hot, dry weather heralds the period of greatest activity of citrus-scale insects. Young scales of the former species are commonly found in large numbers as early in the season as November. The presence of these scales is usually

indicated by a rapid spread of the sooty-mould fungus on the foliage. Spraying with a summer oil 1–60 should be resorted to as soon as the insects become troublesome. The addition of 1 per cent. summer oil to the Bordeaux spray to be applied for verrucosis-control will kill many of the young scales. Red scale is more difficult to control, and in dry

LEMON FRUITS AFFECTED WITH CITRUS-VERRUCOSIS.

seasons at least four applications of summer oil at a dilution of 1–33 may be necessary to effect a satisfactory control. The first application should be made during December–January if young scales are hatching freely, the second in late February, the third towards the end of March, and the fourth about mid-April.

Citrus thrips are usually prevalent during the main blossoming period, after which they have been observed to almost completely disappear from the trees. Late in January or in February they reappear on the fruit and foliage and rapidly multiply as the season advances. Spraying experiments conducted over two seasons by this Department with various specifics indicated that sprays applied during or near the blossoming period had little or no effect on either the amount of thrip injury to the fruit or on the setting of the crop. However, good control of thrips was secured later in the season. The control-measures recommended will be supplied in my subsequent notes.

Mulching.—The need for supplying organic matter to the soil around citrus trees is realized more now than at any previous period. No matter what quantities of fertilizers are applied, the maximum results cannot be expected without an ample supply of humus in the soil. In orchards of mature trees where most of the land is covered by the spread of the branches it is, in some cases, not possible to grow a satisfactory cover crop. Where such conditions obtain an area adjacent to the orchard should be set aside for the purpose of growing organic matter such as lucerne or clover. The crop can be cut several times during the season and applied as a mulch under the spread of the trees. This material very soon decays and mingles with the soil, and at the same time will greatly conserve the soil moisture during the summer and autumn months. Several citrus growers have adopted this practice in recent years with encouraging results.

—P. Everett, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Feeding.

THE primary purpose of feeding is to sustain life, build up waste in tissue, and maintain natural conditions, and, secondly, that certain materials may be transformed into more suitable forms of food for human consumption in the shape of eggs and poultry-meat.

The most commonly used and satisfactory foods for poultry in this country are obtained from grains, such as wheat, maize, barley, and oats; mashes made up of pollard, bran, wheat-meal, oat-pollard, barley-meal, or maize-meal; animal food in the form of meats, meat-meal, milk, or fish-meal; mineral matter in the form of oyster-shell grit, also metal grit and succulent green food. The last, but by no means the least, essential is a good, clean, fresh, and constant supply of water.

All foods are composed of certain substances, which have been grouped by chemists into the six following classes: Water, carbohydrates, protein, fat, ash, and vitamins.

When the food is digested and assimilated each substance performs a particular function in nutrition, promoting growth or egg-production. It will thus be seen that the success to be obtained from the feeding of any particular food or ration will depend, to a large extent, upon the correct balance of the various substances contained therein.

While the feeding of a well-balanced ration will always give the best results where a flock of birds is concerned, there are at times factors beyond one's control, such as climate, soil, and individual temperament when foodstuffs do not always have the same value or the same physical effect upon all systems. The poultry-farmer is advised, however, to give some time to a study of this important branch of his work, and he would be wise to have on hand a table giving the analyses of the various available foods, as such will often be useful and assist in a

more intelligent use of certain foodstuffs. Science has done, and is still doing, great work for the poultry industry, and a perusal of reports from world research workers makes very valuable and interesting reading and is time well spent.

While it is recommended that the poultry-farmer should know something of the composition of the most popular foodstuffs, it is not suggested that the beginner should first spend time and perhaps money in trying to make up or experiment with new mixtures. The novice should really first learn just *how* to feed and manage his birds, and when it comes to exactly what to feed, his best plan would be to follow very closely the methods adopted by some successful poultry-keeper, for the successful man does, as the result of practical experience, feed his birds in a scientific way, although perhaps theoretically he may not know much about how to tell whether a certain ration is scientifically balanced or not.

Process of Digestion.

The process of digestion in poultry differs from that of animals which chew their food. Briefly, science describes the process as follows: Fowls swallow their food and it is passed into the crop without mastication; here it absorbs moisture, which softens it and aids in its passage to the gizzard. The crop is really a store-house for food, and as it is required it is passed into the esophagus or stomach. Here it is mixed with secretion similar to saliva, which acts upon the carbohydrates, converting them into sugars. The food is then passed into the lower stomach, when another juice—the gastric—is poured upon it, thus reacting upon the proteins. After leaving the stomach the food is passed to the gizzard, where, by the aid of powerful muscles and sharp grit, it is ground into pulp. From the gizzard the food is passed into the small intestines, where two more secretions—the bile and the pancreatic juice—are mixed with it. These juices emulsify the fats; they also act upon the carbohydrates and proteins, and continue the work started by the saliva and gastric juice.

The digestible nutrients are taken from the food and converted into blood. This process goes on as follows: The inner walls of the intestines are covered with very small projections, which absorb the digested material from the contents of the intestines. There are two kinds of small tubes within these projections. One kind connects with the waste-gathering system and conducts certain material to a large tube along the backbone, the contents of which are eventually taken up by the blood.

The other kind of tubes belong to the blood-circulatory system; they conduct other digested material to the liver, where it is purified before it is used to build up the body. The indigestible part of the food passes into the rectum, and out of the body.

Breeding and Environment.

In order that this transformation of food may take place in a profitable way it is, of course, essential that the birds possess that inherited constitution in order that all organs of the body can carry out their various functions in a constant and efficient manner. When it comes to great egg-production it must be remembered that birds not only need great stamina so that the system will stand up to the drain of heavy production, but they must be endowed with that inherited faculty which enables them to produce a large number of eggs, for the very best of feeding will not transform a naturally poor layer into a very prolific producer.

These are, of course, matters of selection and breeding, but they must be given careful and constant attention before the most profitable returns can be expected from any particular system of feeding.

Environment.

As environment includes all the external circumstances of an organism and the great function of environment is to sustain, not to modify, it should also be remembered that proper care and management are vital essentials to success.

It is not unusual to find a successful man feeding a certain ration, while his neighbour, who feeds the same class of ration to a similar strain of birds, fails to make a success of the business. This is why many experienced poultry-keepers will argue that good environment is of equal importance as good breeding. Even the very best of birds must be kept in good health, and judgment must be exercised and care taken to see that the quality, quantity, and regularity of the food-supply is correct, and also that sufficient exercise and good housing-conditions are available. These points have been mentioned because the novice, if not getting satisfactory results, often varies his method of feeding, when the fault lies in the direction of some condition existing in the environment.

What to feed.

There are, of course, many different mixtures and systems which have been used successfully. The following is one that is commonly used: A mash made up of two measures of pollard, one of bran, and from 5 per cent. to 10 per cent. of meat-meal (a little extra pollard is added if quality is poor), the lot mixed to a crumbly state with water, skim-milk, or soup. Up to 10 per cent. of meat-meal is fed from about April to August, when it is gradually reduced until by September not more than 5 per cent. is given. The amount of meat-meal may again be gradually increased about November.

Where milk or soup is used to mix the mash, less meat-meal should be used.

This mixture should be fed in troughs and as much given as the birds will clean up in half an hour. It is usual to feed the mash first thing in the morning and grain at night, but it really does not matter whether the mash is fed night or morning. However, it is better not to be always altering the times of feeding. A good feed of succulent green food is given each day; some feed this about noon, while others prefer to give the green food after the last feed in the evening.

Wheat is the most popular grain, and where available a grain mixture that has given good results is made up of three measures of wheat and one each of barley and broken maize. The grain should be fed in deep litter in order to encourage exercise, and as much given as the birds will clean up in about half an hour.

A supply of oyster-shell and metal grit should be always within reach of the birds. Great care should be taken to see that the water-supply is constant, fresh, and clean.

Further feeding notes will appear next month.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of

the summer, if two or more are united or if each one is reinforced by the addition of bees and brood from strong colonies, they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming and saves a great deal of trouble where increase is desired.

Supering.

In most districts November is early enough for the employment of supers, though much depends on weather-conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

Care of Bee-yard.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the

bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—*E. A. Earp, Senior Apiarist.*

HORTICULTURE.

Vegetable Crops.

About the beginning of the month of December, when a variety of vegetables is available, it is advisable to stop cutting asparagus and allow the plants to mature their growth. In doing this they should be assisted by applying a generous dressing of manures and fertilizers. The crop has probably had a few applications of nitrates during the cutting period and now requires a substantial and more varied application. In deciding on its composition it is well to remember that a generous supply of humus in the soil should be maintained and the crop is partial to a good supply of potash, but phosphates must not be altogether omitted. The dressing is applied between the rows and cultivated in. For somewhat similar reasons the rhubarb crop should receive the same attention.

As the early crops of peas, potatoes, salads, &c., are cleared the ground is prepared for such winter crops as celery, leeks, savoys, red cabbage, Brussels sprouts, cauliflower, broccoli, &c. All of these crops are partial to lime, and, in most instances, it is a suitable occasion to apply a generous dressing. If ground raw lime is used (carbonate of lime) it is important that it should be finely ground. Burnt lime in powdered form (hydrated lime) has had the carbon driven off in the burning process; it is caustic, essentially stronger, and quicker in its action. It should be used only on the heavier land. As liming is often neglected, it should be remembered that not only is it required by certain crops, but on heavy land especially it is necessary in order to maintain the soil in a mechanically friable condition while on land inclined to be acid, as is so often the case, it is required to enable such fertilizers as superphosphate and sulphate of ammonia to function effectively. As it leaches out there is no need for anxiety regarding the behaviour of crops requiring an acid soil, such as potatoes, tomatoes, strawberries, &c., that may be planted later; in fact, such crops do rather better on land which is only slightly acid. For this class of cropping lime is sometimes applied annually in moderate quantities such as half a ton to the acre, equal to about 3 oz. to 4 oz. to the square yard, or at longer intervals in quantities up to 2 tons per acre.

A moist soil, rich in humus, and well drained is required to produce a good celery crop. On land of this description such varieties as Golden Self-blanching may be planted 9 in. apart and 12 in. between rows. A wider space should be allowed after every sixth row to give access for spraying, weeding, &c. In preparation for planting a good dressing of manure, such as fowl-manure and, if the land is light, an equal part of cow-manure, is ploughed under. While cleaning the land an application of superphosphate and sulphate of potash is worked in. Where a liberal preparation has been made for the previous crop this treatment may be modified accordingly. Where a larger variety, such as Solid White, is to be grown a good deep drill may be struck at intervals of 3 ft., the fertilizers worked in, and the plants set out in the drills at intervals of 8 in. or 9 in. In dry localities and soils it is necessary to plant out in prepared trenches to economize and facilitate the application of irrigation water. This crop must be kept growing steadily, and

to do this it must not be allowed to lack moisture; irrigation by flooding or sprinklers is frequently necessary to supply its requirements in this respect. To control the attack of leaf-spot disease (*Septoria Apii*) spraying with Bordeaux 3–4–50 is usually necessary at intervals of about three weeks from the seedling stage onwards. Washing-soda may be used in the place of lime (it is then known as a Burgundy mixture), and it is indeed preferable in the later stages of growth, as there is less residue left on the stalks. In any case, care must be taken to see that a thoroughly clean product is placed on the market.

During the month of December a late crop of peas may be sown, also shorthorn carrots, globe beet, lettuce, and, in warm districts, dwarf beans.

An important operation at this season is to mow hedge bottoms and headlands where weeds and rough grass are growing in the vicinity of these crops. If this is done before seeds are formed it will do much to control the spread of weeds, and the material will be useful for mulching, or, if stacked green in the compost heap, humus for application to the land later.

Small and Sundry Fruits.

Planting distances for the tomato crop under glass vary widely in practice. There is often a tendency to crowd the plants with a view to getting the greatest possible weight of fruit from the limited area. At the Cheshunt Research Station last season this matter was the subject of an interesting test, which is to be repeated. Plots were planted 18 in. and 27 in. between rows alternately, and 14 in. between plants. Others with similar spaced rows and 18 in. between plants. Others, again, 27 in. between all rows and 14 in. between plants. And yet others 27 in. between rows and 18 in. between plants. The results indicate that the yield per acre was practically the same with each of the different methods of planting. Also there was little to choose between the different methods as regards the quality of the fruit, which however, tended to be slightly larger where the spacing was wide. Although it was not stated, there would hardly be any doubt that the cost of production would be lower where the spacing was wide and the management would be greatly facilitated. A very fine crop was seen here recently in a heated house spaced 24 in. and 30 in. alternately between rows and about 14 in. between plants. Experience appears to indicate rather strongly that most growers would be wise to increase planting distances, especially where early crops are grown in heated houses, or without heat in the warmer and humid localities. The unseasonable frosts experienced in mid-October in many districts were a considerable check to the early outdoor crop, and the crop under glass should realize good prices for a longer season as a consequence.

Where fine weather and high temperatures are experienced for a long period during the summer it is often an advantage to apply a light shade on crops of tomatoes under glass. This may be done by mixing whiting and linseed oil and applying it to the roof of the house outside in the form of a light spray. With good ventilation and a mulch the plants will then often keep their condition better. In warm districts where a late crop of tomatoes is planted outside about the middle of December the plants will stand up to winter conditions better if nitrogenous manures are used sparingly and the ground is firm when planting out.

The gooseberry crop is in many instances harvested in a green condition, but it should be more generally realized this fruit makes an excellent conserve if gathered as soon as it commences to turn colour and before the skins become tough.

Egg-plants and peppers should now be planted out in the warmer districts. There are signs of an increasing appreciation for these fruits.

The Homestead Garden.

Half-hardy flowering annuals are now available for planting out and are useful for brightening up any desired position in the garden and affording variety and a new interest. In wind-swept, bone-dry, or shaded situations there are plants of this class which will thrive and bloom abundantly in any position if carefully selected. Planting is best done when a period of dull or showery weather may be expected, and if this operation is preceded by working into the soil a little bone-dust and superphosphate, and followed up (if a dry period should be experienced) by occasional irrigation until the plants are established, little further attention will be required.

Thinning, stopping, staking, and tying young growth and buds of plants in the herbaceous border occupies considerable time now if a good display is to be obtained. On that account it is wise to keep this area well within the limits of the labour available.

Where narcissus and other spring-flowering bulbs are to be lifted it is usually best done now as soon as the foliage really commences to die off. The bulbs should not be unnecessarily exposed to the sun, but spread thinly in a well-ventilated shed or other position free from draughts and strong light. When dry they are cleaned, graded for size, and stored in a dry, cool shed until wanted for planting. Some kinds, chiefly from Africa and the Continent of Asia Minor, are rather exceptions to this rule in so much that they can hardly be sun-roasted too much, as in their native state they are accustomed to hot, dry summers. *Iris tingitana*, a native of Tangiers, is a handsome winter-flowering, bulbous iris which in some places refuses to bloom without a summer treatment of this kind. Where it is not desired to lift bulbs of this class the necessary conditions for flowering them satisfactorily may sometimes be provided by covering the plants with a glass frame as soon as they die down, and so providing the dry, hot conditions required during the resting period.

When the bedding plants in the frames are cleared consideration may be given to sowing seeds of perennial herbaceous plants such as anemone, pansy, viola, primrose, polyanthus, &c.; also biennials, such as stocks and wallflowers; and during the months of February and March hardy annuals, including sweet peas, for flowering during winter and spring.

During dry periods in summer late-planted shrubs and those, such as rhododendrons, which like moisture, should be watered well and given a light mulch of half-decayed stable manure or lawn clippings, &c. Young climbing plants set at the base of a warm wall will be specially grateful for such attentions.

As garden operations have to be planned for at least twelve months ahead special consideration should be given now to the requirements of the planting season, whether it be for timber or shelter, fruit or flowers —the kind, variety and number of each required should be decided and the position they are to occupy. Also any removals of young trees or shrubs into a different position in the garden that may be required should now be decided on. Notes of this kind made during the summer and the local nurseries searched for suitable stock, will enable the preparation of the land to be undertaken in due season and planting done to best advantage.

—*Wm. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: OCTOBER, 1937.

Dominion Meteorological Office.

NOTES FOR OCTOBER.

IN the Dominion as a whole October was a very dry month with a good deal of wind, which came mainly from a southerly quarter. The atmosphere was generally dry and cool and frosts were unusually numerous, especially in the South Island. Though there is, in most districts, as yet no acute shortage of feed, the growth of pastures and vegetation generally has been poor. The rains from the 23rd onward relieved conditions considerably in the North Island, but the subsequent fine weather with drying winds has, to a considerable extent, nullified their effect. Grass is tending to flower early, and while still short. Stock are, on the whole, in very good condition, especially lambs. Conditions are very favourable also for shearing. In portions of Marlborough, however, there is serious shortage of feed, and both stock and crops are doing poorly. General steady, soaking, and mild rains are needed soon or the effects of the dry weather are likely to become serious.

Rainfall.—Except for some good rains on the west coast of the South Island in the early part, the first three weeks of the month were extremely dry, many areas in the North Island having no rain at all. Between the 23rd and the 26th there were general rains, with heavy falls over most of the North Island. In the South Island few places recorded half the average for October, and large parts of Canterbury and Marlborough had deficits of over 80 per cent.

Temperatures.—Though there were no severe cold snaps, the average temperatures were almost everywhere considerably below normal. The frosts, though unusually frequent, were not of great depth or severity, and though tomatoes, potatoes, and other garden crops were damaged, fruit-trees suffered comparatively little.

Sunshine.—The month was remarkable for the amount of sunshine. Lake Taupo reports 281·4, Nelson 266·9, and Blenheim 261·5 hours.

Storms and Pressure Systems.—During the first nine days conditions were fairly typical of spring. Two westerly depressions crossed the South Island, causing some rather boisterous north-westerly winds as they approached and south-westerlies as they passed away. There were some heavy rains on the west coast of the South Island, but little elsewhere.

From this period onward high pressure was the rule, and the anticyclones were centred unusually far south. Southerly or south-easterly winds predominated and the situation was of a type which, though not very uncommon in summer, was the reverse of what is expected in spring.

Between the 13th and the 18th a moderate cyclonic depression passed across the north Tasman Sea and by Norfolk and the Kermadec Islands. On the 16th it caused easterly gales in the far North and some rain fell in the northern and eastern districts of the North Island. The centre was too far north to affect New Zealand greatly. It did cause, however, an increased flow of air from the south and south-east, and it was during this period that the worst of the frosts were experienced.

From the 23rd to the 27th a shallow cyclone developed in the northern part of a depression approaching from the Tasman Sea and moved slowly across the North Island. This was responsible for the general rains already referred to and snow on the ranges, expecially in the South Island. South-easterly gales were experienced in the Cook Strait area. On the 24th there were some severe thunderstorms in the Auckland Province.

From the 28th onwards the weather was again dominated by an anticyclone. On the 31st south-westerly winds on the southern side of it began to cause rain on the west coast of the South Island.

RAINFALLS FOR OCTOBER, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Fall.	Total Rainfall to Date.	Average Rainfall to Date.
		North Island.				
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	0·79	7	0·33	5·27	50·72	48·93
Russell	1·52	7	0·88	3·83	86·47	51·67
Whangarei	1·96	12	0·75	4·76	74·33	54·71
Auckland	2·07	6	1·02	4·06	38·11	42·58
Hamilton	1·12	7	0·58	4·60	32·97	42·03
Rotorua	4·21	6	2·68	5·19	40·71	47·10
Kawhia	..	..	..	5·15	..	45·90
New Plymouth ..	3·14	..	..	5·46	48·06	50·79
Riversdale, Inglewood ..	4·37	9	1·72	10·41	74·68	87·57
Whangamomona ..	..	..	..	8·43	..	64·53
Hawera	2·27	8	1·07	4·65	33·30	38·18
Tairua	2·78	3	1·69	5·81	46·65	56·44
Tauranga	4·90	4	3·58	5·11	47·19	45·52
Maraehako Station, Opotiki	1·86	7	0·74	5·35	51·82	47·29
Gisborne	3·36	10	1·50	2·67	35·16	39·95
Taupo	1·97	8	0·99	4·31	27·20	37·43
Napier	2·71	10	0·93	1·89	22·18	26·12
Hastings	2·09	10	0·83	2·11	18·07	28·16
Taihape	1·87	13	0·40	3·50	25·75	30·06
Masterton	1·79	11	0·40	3·24	27·99	32·78
Patea	2·06	8	1·07	4·25	34·50	37·28
Wanganui	1·45	3	0·67	3·46	25·59	30·18
Foxton	1·05	6	0·57	2·94	18·95	26·67
Wellington	0·94	7	0·30	3·51	28·07	36·38
		South Island.				
Westport	4·02	7	1·45	8·70	64·25	79·50
Greymouth	4·27	9	1·70	10·74	77·31	83·80
Hokitika	5·10	10	1·96	11·81	83·45	94·12
Ross	..	..	..	14·77	..	109·58
Arthurs Pass	..	..	..	20·33	..	131·69
Okuru, South Westland	4·39	3	2·62	15·21	116·47	120·90
Collingwood	0·78	7	0·37	10·08	63·76	82·03
Nelson	0·48	4	0·26	3·50	25·50	31·94
Spring Creek, Blenheim	0·34	5	0·15	2·56	20·41	25·79
Seddon	0·43	4	0·36	2·23	20·27	20·99
Hanmer Springs ..	1·89	9	0·35	3·92	28·61	37·83
Highfield, Waiau ..	1·32	9	0·31	2·60	19·07	28·12
Gore Bay	0·75	8	0·23	2·33	26·01	26·58
Christchurch	0·28	6	0·18	1·97	18·58	20·89
Timaru	0·30	6	0·15	1·98	16·36	18·31
Lambrook Station, Fairlie	0·34	5	0·18	2·06	14·65	20·37
Benmore Station, Clearburn	..	..	..	2·30	..	20·25
Oamaru	0·34	5	0·16	1·76	13·22	17·84
Queenstown	0·41	5	0·19	3·31	21·38	25·28
Clyde	0·09	2	0·08	1·62	11·68	12·12
Dunedin	0·80	8	0·33	3·09	33·05	29·97
Wendon	1·11	6	0·36	2·73	33·64	24·42
Balclutha	0·87	5	0·44	2·42	26·66	20·58
Invercargill	1·37	12	0·39	4·35	34·16	37·37
Puysegur Point ..	3·39	20	0·51	8·13	69·84	69·84
Half-moon Bay ..	2·48	13	0·41	5·17	48·07	48·10